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Disertační práce

Školitel: Prof. RNDr. Petr Pavlínek, Ph.D.

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Prohlášení

Prohlašuji, že jsem závěrečnou práci zpracoval samostatně a že jsem uvedl všechny použité informační zdroje a literaturu. Tato práce ani její podstatná část nebyla předložena k získání jiného nebo stejného akademického titulu.

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PAVLÍNEK, P., ŽENKA, J. (2010): The 2008–2009 automotive industry crisis and regional unemployment in Central Europe. Cambridge Journal of Regions, Economy and Society, 3, No. 3, pp. 349-365.

PAVLÍNEK, P., ŽENKA, J. (2011): Upgrading in the automotive industry: firm-level evidence from Central Europe. Journal of Economic Geography, 11, No. 3, pp. 559-586.

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Abstrakt

Disertační práce vychází z perspektivity globálních hodnotových řetězců a globálních produkčních sítí, které poskytují vhodný konceptuální rámec pro analýzu pravděpodobnosti delokalizace a intenzity průmyslového upgradingu. Průmyslový upgrading je považován za nezbytnou podmínku udržení konkurenceschopnosti vyspělých zemí, které čelí růstu cen výrobních faktorů.

V první části práce se autor zabývá otázkou, které obory zpracovatelského průmyslu Česka jsou nejvíce ohroženy přesunem výroby do zahraničí a zda dochází ke koncentraci mezinárodně mobilních, nákladově orientovaných investic v zaostávajících regionech s vysokou mírou nezaměstnanosti a dostupnými investičními pobídkami. V druhé části byla pro období 1998-2006 měřena intenzita upgradingu široce vymezeného automobilového průmyslu Česka, jakožto nosného oboru české ekonomiky. Cílem bylo zjistit, zda byly firmy v automobilovém průmyslu Česka schopny inovovat a modernizovat své výrobní kapacity pro udržení konkurenceschopnosti navzdory rostoucím nákladům i poklesu poptávky v krizovém období 2008-2009. Vzhledem k nadměrné orientaci české ekonomiky na automobilový průmysl byly očekávány významné dopady na vývoj regionálního vzorce nezaměstnanosti.

Pro tyto účely byly vytvořeny dvě unikátní databáze mikrodat, založených na ročních podnikových výkazech Českého statistického úřadu. Pro účely analýzy rizika delokalizace byla použita databáze 692 firem nad 100 zaměstnanců v zahraničním vlastnictví ve zpracovatelském průmyslu (pro rok 2004). Pro měření intenzity upgradingu a dopadu krize na nezaměstnanost byla využita databáze 490 podniků nad 20 zaměstnanců v dodavatelském řetězci automobilového průmyslu, která čerpala mj. i z 274 dotazníků z roku 2009. Všechny články byly založené na statistické analýze výše uvedených dat.

Většina pracovních míst ohrožených delokalizací byla identifikována nikoli v low-tech oborech, ale v medium-high-tech dodavatelských oborech automobilového průmyslu. Nebyl potvrzen signifikantní trend soustředění mezinárodně mobilních firem do ekonomicky zaostávajích regionů – s výjimkou vyšší koncentrace „nomádských“ závodů v periferních okresech Plzeňského a Karlovarského kraje v blízkosti německých hranic.

Navzdory extenzivnímu charakteru růstu automobilového průmyslu Česka v letech 1998-2006 byl zaznamenán intenzivní průmyslový upgrading ve skupině firem v českém i zahraničním vlastnictví. Kontinuální procesní upgrading posunul kvalitu, spolehlivost i produktivitu práce automobilového průmyslu Česka na úroveň srovnatelnou se západoevropským automobilovým průmyslem. V období krize 2008-2009 vykázal český automobilový průmysl překvapivě vysokou odolnost a lokalizační stabilitu, neproměnil tradiční regionální vzorec nezaměstnanosti v Česku. Nebyla nalezena souvislost mezi postavením firmy v hodnotových řetězcích a náchylností ke kolektivnímu propouštění zaměstnanců. Ve skupině dodavatelů třetího řádu, zaměřených na výrobu náročnou na pracovní sílu, bylo zaznamenáno více případů firemních bankrotů a uzavření výrobních závodů.

Funkční upgrading byl navzdory vysoce selektivnímu charakteru identifikován jako nejvýznamnější proces, na základě něhož se mohou regiony Česka posunout na vyšší příčky hodnotových řetězců automobilového průmyslu EU. Hlavní odlišností automobilového průmyslu Česka od evropského jádra je výrazně nižší koncentrace center výzkumu a vývoje a obecně strategických funkcí, které vytvářejí vyšší přidanou hodnotu. Na základě statistické analýzy vývoje kapacit výzkumu a vývoje bylo však zjištěno, že se automobilový průmysl Česka vymanil z periferní pozice středoevropských zemí a přiblížil se zemím na semiperiferii evropského automobilového průmyslu – Španělsku, Belgii a Rakousku.

Klíčová slova: průmyslový upgrading, regionální rozvoj, automobilový průmysl, výrobní sítě, hodnotové řetězce, delokalizace, lokalizační inercie, Česko, střední Evropa

Abstract

This dissertation thesis draws on global value chains and global production networks perspective in order to analyze and measure the probability of international relocation of production and the intensity of industrial upgrading. Continuous industrial upgrading may be regarded as vital precondition for higher-cost countries to maintain their competitiveness face-to-face increasing costs of production factors.

In the first part, the author asked which manufacturing industries in Czechia are the most threatened by relocation of production activities to lower-cost countries and if the cost-oriented "nomadic" investments are concentrated in economically less developed regions with high unemployment rate and available investment incentives. In the second part, the author measured the intensity of industrial upgrading in the broadly defined Czech automotive industry since 1998, which is considered a key branch of the Czech economy. The question was whether the Czech-based automotive firms were able to upgrade their production activities in order to maintain competitiveness despite rapidly growing production costs and falling demand during the EU automotive industry crisis in 2008-2009, so that significant impacts on the traditional regional pattern of unemployment in Czechia were expected.

Two unique databases based on the data of the Czech Statistical Office were constructed: the database of 692 foreign-owned manufacturing firms with 100 and more employees (2004) for the analysis of manufacturing location inertia; moreover, the database of 490 Czech-based plants employing more than 20 workers that were part of the automotive value chain in 2006 for measuring the intensity of industrial upgrading. This database included also results of the questionnaire survey among 274 Czech-based automotive firms. All published papers used statistical analyses to measure either the probability of international relocation, the intensity of industrial upgrading or the position in the production network.

The majority of jobs threatened by relocation were not found in low-tech industries, but in medium-high-tech supplying industries of internally heterogenous automotive value chain. No significant trend towards the concentration of nomadic firms into economically lagging districts was found – except for higher representation of nomadic plants in peripheral areas of Plzeňský and Karlovarský region near the German borders.

Despite the extensive FDI-driven character of growth in the Czech automotive industry between 1998 and 2006, significant processes of industrial upgrading were identified in both domestic and foreign-owned firms. Continous process upgrading increased quality, reliability and labor productivity to levels comparable with the Western European automotive industry. Therefore, during crisis the Czech-based automotive industry exhibited surprisingly high resistence and strong location inertia when facing rapidly falling demand. The 2008-2009 automotive industry crisis did not significantly alter the traditional regional pattern of unemployment in Czechia. No clear relation between a firm's position in the value chain and its propensity to layoff employees was identified. However, in the group of third-tier suppliers oriented on the labor-intensive production bankruptcies/plant closures were more often.

Despite its highly selective character, functional upgrading was identified as the vital process through which Czech-based firms and regions can move to the upper parts of the European automotive value chains. What differs Czechia from the EU automotive core is significantly lower concentration of R&D centres and generally strategic functions, generating higher value added. Nevertheless, the statistical analysis revealed that in term of R&D intensity Czechia broke to a certain degree out of the Central European peripheral position and gradually converged to the level of countries in the semi-peripheral position of the EU automotive value – Spain, Belgium and Austria.

Key words: industrial upgrading, regional development, automotive industry, production network, value chains, delocalisation, location inertia, Czechia, Central Europe

1. Introduction

This dissertation thesis deals with two distinctive, but inherently interconnected phenomena – manufacturing location inertia and industrial upgrading. Continuous industrial upgrading is considered to be vital for maintaining long-term competitiveness in regions shifting from factor-driven stage to the efficiency-driven and later to the innovation-driven stage of competitiveness (Sala-i-Martin, Artadi 2004). Therefore, the intensity/dynamics of industrial upgrading, understood as a shift to more profitable and higher value-added activities, is a crucial factor influencing not only the probability of relocation of production activities, but also other mechanisms through which firms may contribute to the regional development. Three issues, highly relevant for the prospects of regional development in regions undergoing the above mentioned transition were analysed in more detail. *Firstly*, collective dismissals by the subsidiaries of foreign-owned TNCs at times of economic slowdown (caused not only by relocations, but also by bankruptcies and in situ internal restructuring), *secondly* – establishment of R&D centres and *thirdly*, the position of domestic-owned firms in production networks orchestrated and coordinated by the lead firms located abroad.

Proposed reserarch was empirically oriented and aimed at providing recommendations for the design of the Czech industrial policy. The thesis consists of **four papers that have been already published** in peer-reviewed journals (see below). Main conclusions are proposed in a **common introduction**, which also provides more detailed theoretical discussion of concepts used in below mentioned papers and related methodological issues.

ŽENKA, J. (2009): Delocalization of the Czech Manufacturing Industry (a component analysis). Politická ekonomie, 57, No. 1, pp. 77-91. [in Czech]

ŽENKA, J., ČADIL, V. (2009): Regional Distribution of Technology-Intensive Manufacturing Industries in the Czech Republic with an accent on Risk of Delocalization. Prague Economic Papers, 1, pp. 61-77.

PAVLÍNEK, P., ŽENKA, J. (2010): The 2008–2009 automotive industry crisis and regional unemployment in Central Europe. Cambridge Journal of Regions, Economy and Society, 3, No. 3, pp. 349-365.

PAVLÍNEK, P., ŽENKA, J. (2011): Upgrading in the automotive industry: firm-level evidence from Central Europe. Journal of Economic Geography, 11, No. 3, pp. 559-586.

First two papers were based on results of author's applied research for the Ministry of Industry and Trade in 2006. The goal of the research was to develop recommendations for the Czech industrial policy regarding the state support of foreign direct investment (FDI). More specifically, this analysis was intended to adjust the rules for providing investment incentives by the Czech Investment Promotion Agency.

The **first research question** of this thesis was thus to determine which manufacturing industries in Czechia are most threatened by relocation of production activities to Eastern European and Asian lower-cost countries.

Due to the fact that the probability of international relocation is multicausally determined, the research was focused on identification of those production and assembly plants, owned and operated by TNCs, whose entry into the Czech economy has been primarily motivated by cost reductions and exploitation of investment incentives. Foreign-

owned and controlled production and assembly plants are most likely to be relocated (not only) to lower-cost countries (Bruinsma, Gorter, Nijkamp 2002; Coucke, Pennings, Sleuwaegen 2005; Pennings, Sleuwaegen 2006, 2002a, 2002b, 2000), because multiplant transnational corporations are generally more mobile (Dicken 1976). Economic activities of this kind are not long-term sustainable in CE countries, where the production factor costs (especially wages) have been rapidly growing. Therefore, among subsidiaries of foreign-based TNCs, plants, whose competitiveness is based on temporary competitive advantages in lower-costs countries, are most likely to delocalize their economic activities (Pennings, Sleuwaegen, Monmaerts 2000; Tiggeloove, Vossen 2005). Cost-motivated and disembedded investments are considered "*footloose*", not creating intensive linkages to the host region and not having specific localisation claims to labour force qualification, proximity of suppliers, clients, universities and other R&D institutions. Footloose investments are likely to be concentrated in regions offering opportunity for the highest costs reduction.

The **second research question** was to determine whether footloose assembly/production activities are rather localized in economically less developed regions with high unemployment rate and available investment incentives, therefore regions potentially threatened by delocalization of manufacturing activities the most.

As noted above, continuous industrial upgrading is a necessary precondition for firms to remain competitive and to prevent the international relocation of production. Therefore, the **second part of this dissertation is aimed at the issue of upgrading in the broadly defined Czech automotive industry**, including firms in supplier industries such as machinery, iron and steel industries, rubber, plastics or textiles. In the next section, the most important arguments for choosing the Czech automotive industry as a case study for analysis of the industrial upgrading in the Central European (CE) manufacturing industries were outlined.

Automotive industry is not only a key branch of the Czech economy, but it is also important in absolute numbers in the EU context. Czechia is the 6th largest car producer in the EU and Czech supplier firms are plugged into the production networks of all major EU-based automotive assemblers. It provides a perfect example for studying issues of industrial upgrading because of the very favorable geographic location of Czechia, industrial tradition, unique case of successful transformation of Škoda Auto, complexity and high internal heterogeneity of technology/labour-intensity of the automotive value chain. Therefore, Czech automotive value chain provides rich empirical material for analyzing the relationships between the subsidiaries of TNCs and highly developed base of domestic supplier firms (Pavlínek 2002).

Automotive industry is thus an industry of industries. The complexity of the automotive value chain enables us to study the intensity of industrial upgrading in firms of almost all size categories – both domestic and foreign-owned, low and high-tech industries, from lead firms (assemblers) on the top of the value chain to the suppliers classified into three tiers according to the complexity and technology-intensity of parts and components supplied to the assembler. Moreover, regional distribution of the automotive production and employment in Czechia is highly uneven. Almost one quarter of 206 Czech microregions may be considered as over-dependent on the automotive industry – the share of the broadly defined automotive industry in total employment exceeds 10% or more, which is twice more than is the national average. Significant impacts on the development of regional disparities can thus be expected especially at times of economic crisis.

The **third research question** is to what extent has the economic crisis of the Czech/EU automotive industry in 2008-2009 affected the development of regional disparities in unemployment in Czechia. More specifically, we also tested hypothesis that regions hosting firms on the lowest tiers of automotive value chains will be hit by collective dismissals more than regions hosting lead firms and first-tier suppliers.

One of the most important features of internationalization of the automotive industry is the integration of production networks on the macro-regional (rather than global) scale (Bailey 2010, p. 313). The specificity of the largest macro-regional markets (traditionally USA, Western Europe and Japan, recently also China, India and Brazil), high transport costs, modular regime of production, just-in-time deliveries and also various (non)tariff barriers require the presence of assemblers on each market as well as the geographic proximity of assemblers and first-tier suppliers (Sturgeon, Biesebroeck, Gereffi 2008). These spatial constraints do not favor the global configuration of the value chain and lead to the development of core-periphery pattern of the international division of labour on the macro-regional scale.

Based on the position of the countries in the automotive value chains, Domanski and Lung (2009) describe the core-periphery spatial pattern of the organization of the European automotive industry. The core "blue banana" regions in Germany, France, Italy and to some extent UK, host headquarters of the major assemblers and suppliers, keep technology capabilities and strategic functions generating high value added such as design, R&D and marketing. Lower tiers of value chains such as labour-intensive assembly and production of small cars and simple components tend to be concentrated in the broadly defined European periphery including Czechia and other CE countries. Semi-peripheral (or pericentral – Lung 2004) countries and regions such as Austria, Belgium, Eastern Germany and Spain developed higher value-added production and R&D except for the core functions associated with corporate HQs.

However, at the same time Domanski and Lung (2009) emphasize the dynamic and relational character of the European periphery, which has been increasingly specialized on manufacturing of more complex and sophisticated high value added products. *"High-volume production, especially in component manufacturing, means that they escape a classic weakness of peripheral markets: limited demand and lack of economies of scale. Production processes are increasingly characterized by advanced technology, sophisticated skill requirements, state-of-the-art organization of production and to some extent nonproduction competences"* (Domanski, Lung 2009, p. 9). They also argue that the peripheral position is not determined once and for all and highlight the shift of Spain from the peripheral in 1970s and 1980s to the semi-peripheral position in 1990s and also the retreat of UK automotive industry from the core position.

Pavlínek, Domanski and Guzik (2009) document the evolution of a dual[1] specialization of the CE automotive industry together with increasing, but highly selective engagement of foreign-owned CE based assemblers and FTSs in R&D functions. They argue that despite the increasing level of capital and R&D intensity and shift to the higher-value-added activities, the peripheral position of the CE automotive industry has been reinforced by the foreign ownership. Authors emphasize strong dependence of CE regions on foreign know-how, technology, management practices and R&D as well as high level of external control, meaning that the most important strategic planning and investment decisions are made outside the CE regions (Pavlínek, Domanski, Guzik 2009, p. 60).

[1] low-value-added and labour-intensive products and small cars on one hand and more technology and capital intensive products on the other

Recent papers (Pavlínek, Domanski, Guzik 2009; Domanski, Lung 2009; Pavlínek, Ženka 2011) agree on high level of internal heterogeneity of the CE automotive industry in terms of value creation, technology intensity and the concentration of R&D functions. Increasing wage levels in all CE countries including Czechia have to a certain degree deteriorated not only the attractivity, but also the sustainability of CE countries for the location of export-oriented manufacturing assembly plants. Therefore, continual introduction of both product and process innovations and functional upgrading in terms of shift to more profitable, higher-value added activities has become necessary for maintaing the competitiveness of CE manufacturing industries.

The second part of the dissertation thesis is focused on Czechia as the largest car producer in CE, which combines the advantages of geographic position together with industrial tradition, technically skilled labour force and the unique case of transformation of Skoda Auto. Among all CE countries Czechia probably exhibits the highest propensity to move to the upper-parts of the automotive value chain, which may be documented by the highest R&D expenditures in the CE (Pavlínek, Ženka 2011).

The fourth research question is thus whether and to what extent has been the Czech automotive industry moving to the semi-peripheral position in the European automotive value chain in the period of massive FDI inflow since the introduction of investment incentive schemes by Czech Invest in 1998.

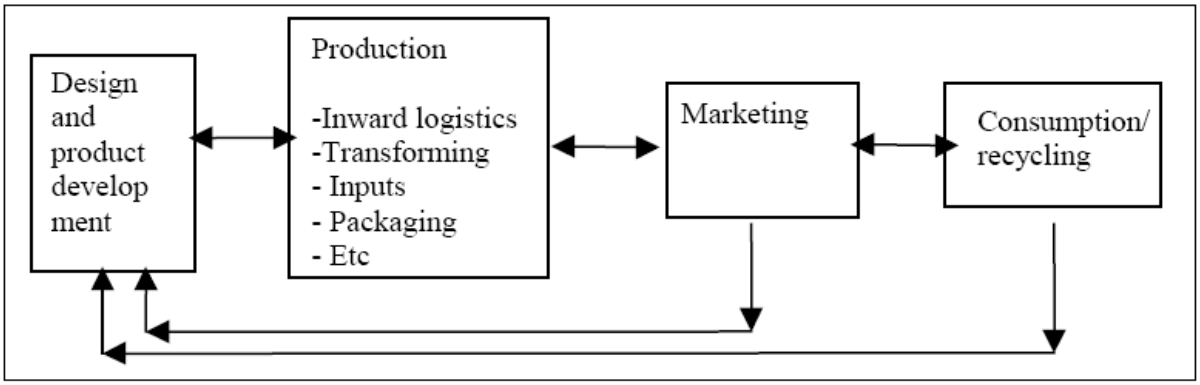
The main purpose of this thesis is to analyse the intensity of industrial upgrading. The concept of regional development potential has been added to the analysis of industrial upgrading in order to make the results accessible and interesting also for scholars outside the narrow group of specialist in the industrial upgrading and the automotive industry. Moreover, regional development provides a ground for handling broader spectre of issues connected to the concept of industrial upgrading – location inertia, regional embeddedness, collective dismissals, external control and establishment of higher value-added and strategic functions such as R&D centres.

We are aware that even the conceptualisation of the regional development impacts of TNCs itself is very complex and requires broader theoretical discussion, which is beyond the scope of this dissertation thesis. Therefore, for the purpose of our research, we use a simple conceptualisation of regional development impacts of particular automotive firms. The highest contribution to the regional development is expected to be found in the case of domestic-owned or highly embedded foreign-owned firms, characterized by inertial location, low propensity to the collective layoffs, existence of strategic (non)production functions generating high value added, earnings, wages and thus also high corporate taxes (Dicken 1976; Bruinsma et. al. 1998; Kolinsky 1998; Pennings, Sleuwaegen 2000; Meijboom, Voordijk 2003; Coe et. al. 2004; Pavlínek 2004; Pavlínek, Ženka 2010). Regional development potential is thus defined as a firm's ability to generate value and reinvest profit inside the host region territory and continually upgrade processes, products and technologies in order to remain international competitiveness. Therefore, in section **X** we seek to conceptualize the notion of value and factors determining generation and distribution of value in the value chain as well as region's prospects of capturing and enhancing value.

2. Value chains and production networks

A value chain is a sequence of value-adding activities that bring a product or service from conception, design and development through different stages of production (including inward logistics, transformation of raw materials, production of components and final assembly), outward logistics, marketing, consumption and recycling (Kaplinsky, Morris 2001, see Fig. 1). Value chains may evolve and operate in all geographical scales and usually link production activities on global and sub-national (or even local) level – see Sturgeon 2001. For the purposes of this thesis, we use the concept "global value chains – GVC" (see e.g. Humphrey, Schmitz 2000; Gereffi 2001; Gereffi, Humphrey, Sturgeon 2005; Sturgeon 2008), which specifically highlights the coordination of economic activities on international and global level. The GVC approach is in fact a further elaborated and modified concept of "global commodity chains – GCC", developed by Gereffi and Korzeiniewicz (1994) who revived the idea of commodity chains by Hopkins and Wallerstein (1986).

Fig. 1 Simple value chain



Source: Kaplinsky, Morris 2001, pp. 4

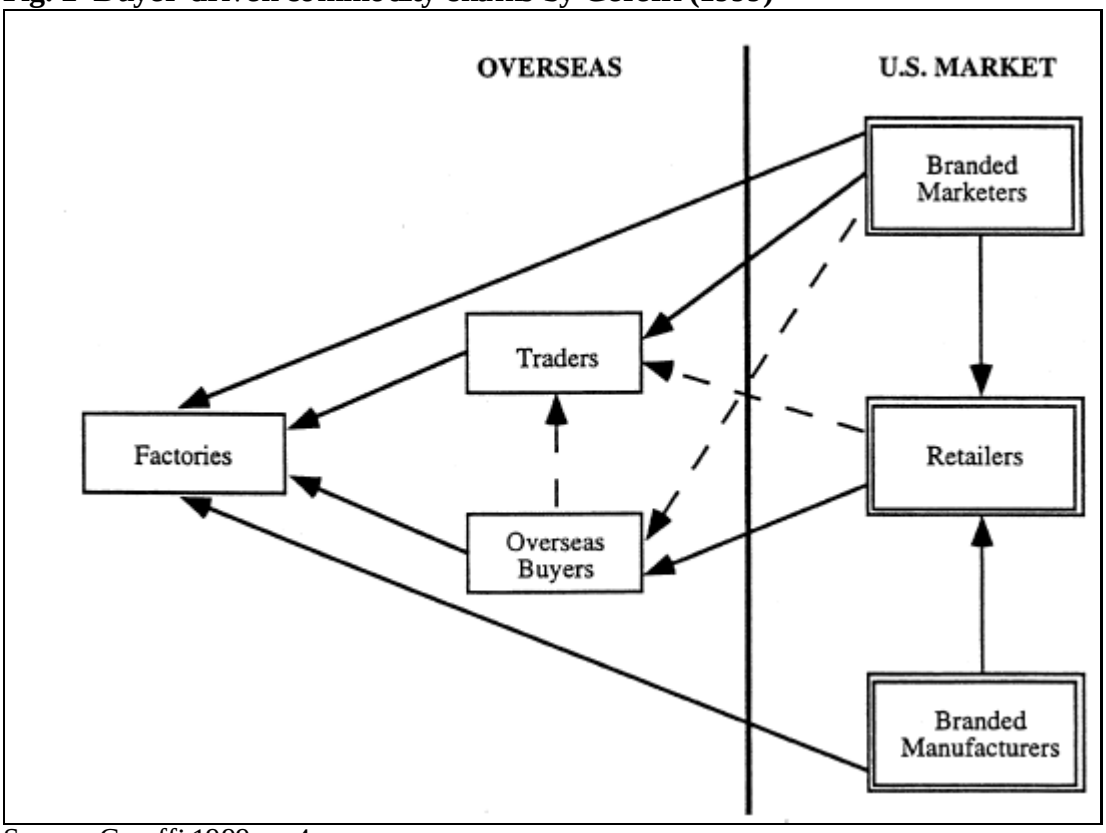
The GCC approach (see also Gereffi 1999, 2001; Reikes, Jensen, Ponte 2000) was oriented on the power relations imbedded in the commodity chain and the issues of chain governance by lead firms, which strongly influence the prospects of industrial upgrading. Originally, the commodity chains were developed by Hopkins and Wallerstein and incorporated into the world system theory in order to describe the fundamental relationships sustaining and reproducing the world core-peripheral patterns (Korzeiniewicz, Martin 1994). It has been widely assumed that certain commodities, production processes or the stages of value chains do not generate the same amount of value: manufacturing compared to the raw materials, advanced and technology or capital-intensive products compared to nondurable low-tech consumer goods (Korzeiniewicz, Martin 1994). Moreover, within a single commodity chain significant differences between the profitability of value-adding activities have been found – design, R&D, marketing and branding compared to the simple production or assembly, as the sources of profitability have increasingly shifted from tangible to non-tangible knowledge-intensive processes (Kaplinsky 2000).

Gerreffi has explicitly highlighted the coordination role of the lead firms that have power to establish and determine the overall character of many supplier chains, orchestrating the globally dispersed but linked production systems. The chain governance and distribution of power to a large extent determine the distribution of wealth along the value chain (Kaplinsky, Morris 2001). The regional development impacts of particular firms are thus heavily influenced by their insertion and position in commodity chains. The main contribution of Gereffi's seminal work has been the distinction between two generalized types of value

chains according to the concept of chain governance, buyer-driven and producer-driven commodity chains.

In buyer-driven commodity chains the large retailers, marketers and branded manufacturers play a pivotal role of lead firms that establish, coordinate and govern the decentralized networks of suppliers (Fig. 2). The power of lead firms is derived from the orientation on knowledge-intensive activities with high barriers of entry – design, marketing and branding. All production activities including the final fabrication or assembly can be thus outsourced to the tiered structure of suppliers located mostly in developing low-cost countries. This kind of trade-led industrialization has become typical for labour and marketing-intensive industries oriented on the production of consumer goods – such as garments, footwear, furniture and other hand-crafted items, house wares, toys or consumer electronics (Gereffi 1994). Profits in buyer driven commodity chains are derived *"from unique combinations of high-value research, design, sales, marketing and financial services that allow the retailers, branded marketers and branded manufacturers to act as strategic brokers in linking overseas factories with evolving product niches in the main consumer markets"* (Gereffi 1999, p. 43).

Fig. 2 Buyer-driven commodity chains by Gereffi (1999)

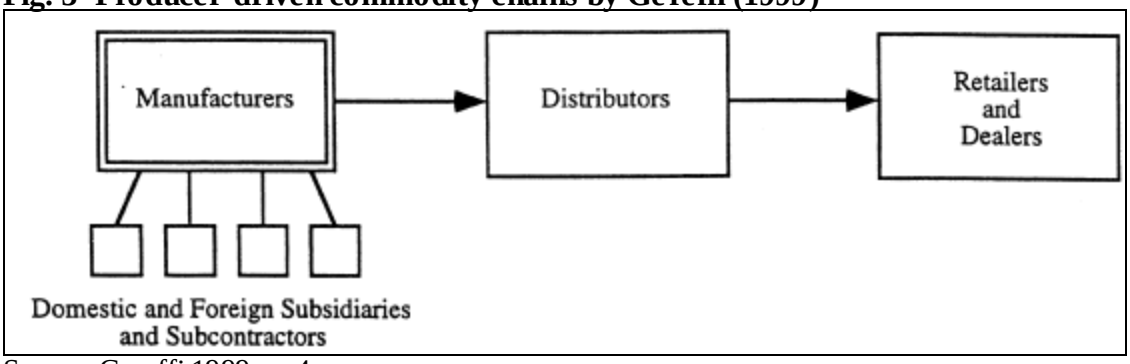


Source: Gereffi 1999, p. 4

Producer-driven commodity chains (Fig. 3) are typical for capital and some technology-intensive industries, in which the position of lead firms is occupied by large, usually transnational manufacturers (Gereffi 1994). The typical example of producer-driven commodity chains can be the manufacturing of automobiles, aircrafts, computers and semiconductors. These leading manufacturers orchestrate the internationally dispersed and usually tiered structure of suppliers and exert control over the backward linkages with raw material and component suppliers and forward linkages towards the distribution and retailing (Gereffi 1999). The most profitable phase of the commodity chains is found within the most oligopolized value-adding activities with high barriers to entry – in this case for example in

design, development, manufacturing of the most sophisticated components and final assembly of automobiles (Kaplinsky 1998).

Fig. 3 Producer-driven commodity chains by Gereffi (1999)



Source: Gereffi 1999, p. 4

In the case of producer-driven commodity chains profits are derived from economies of scale, volume and technological advance, which often allow lead firms to set the technical standards for suppliers (Gereffi 1994). The transactions in producer-driven chains are often in the form of internal hierarchical relationships among the various subsidiaries of a particular transnational manufacturer, because in many cases the lead firms are not willing to outsource and thus share their technological advance, which constitute their principal sources of competitiveness. For buyer-driven chains the intra-firm transactions are more common, because the suppliers that are focused on production and assembly do not tap into the principal competences of the lead firms (Gereffi 1999). However, buyer- and producer-driven commodity chains exhibit similar network morphology: both are being orchestrated from the clearly identifiable centre on the top of a GCC (Sverrison 2003).

As noted above, Gereffi's GCC approach has been transformed into a more convenient concept of global value chains, which was designed in order to capture the on-going changes of the global economy. Gereffi, Sturgeon and Humphrey (2005, p. 83-85) proposed more subtle classification of corporate governance, distinguishing among five basic types of value chains – markets, modular, relational and captive value chains and hierarchies. Their classification of value chain governance is based on three criteria – complexity of information/knowledge transmitted among the firms in the value chain, codifiability of information enabling firms to reduce transaction costs and capabilities of suppliers with regard to technology, logistic and quality requirements of their principal customers. Sturgeon (2008) summarized the main shortcomings of the GCC approach and the most important changes in the governance of value chains.

Firstly, significant deverticalization of transnational companies (especially manufacturers) changed the nature of relationships in commodity chains toward the enforcement of inter-firm linkages. Outsourcing of production, logistics and even development activities became more common even in the producer-driven chains.

Secondly, the introduction of advanced information and communication technologies together with better global standards of business processes and products has enabled the creation of modular and network linkages between lead firms and suppliers. Producer-driven chains including the automotive industry thus became more buyer-driven, as the competitive pressures forced the lead firms to concentrate on their principal activity and outsource the peripheral functions in order to reap the scale and scope economies and also share risks of investment in new products and technologies with their suppliers. The GVC approach has thus highlighted the distribution of power and also value along the value chains, various forms of governance and corresponding prospects of industrial upgrading of firms and regions

inserted into the GVCs. The main contribution is thus the shift from the simple bimodal distinction between buyer- and producer-driven commodity chains to more sophisticated typology of value chains governance. (see Gereffi, Humphrey, Sturgeon 2005; Humphrey, Schmitz 2000, 2002, 2004).

Thirdly, Humphrey and Schmitz (2000) also highlighted misleading character of the term commodity, which connotes standardized and undifferentiated materials or products. It is thus not useful for the description of recent value chains (especially in the automotive industry) that include mostly the exchange of highly differentiated components (see also Henderson et. al. 2002).

The GCC and GVC approach were critically revised and further developed in a concept of global production networks (Henderson et. al. 2002; Ernst, Kim 2002; Coe, Dicken, Hess 2004). The definition of production network is quite similar to the value chain. Coe, Dicken and Hess (2008, p. 274) describe the production network as *"…the nexus of interconnected functions, operations and transactions through which a specific product or service is produced, distributed and consumed. A global production network is one whose interconnected nodes and links extend spatially across national boundaries and, in so doing, integrates parts of disparate national and subnational territories"*. There are, however, differences in conceptualisation and empirical application of the GPN and GVC approach. GPN seems to be more geographically relevant concept with better applicability in the realm of industrial upgrading and regional development implications of FDI (see Henderson et. al. 2002; Coe, Dicken, Hess 2004, 2008). The most important distinctions that make GPN concept more suitable for the goals of this thesis are:

a) While GVC refers to an idealized sequence of value adding activities leading to an end-use of products, GPN can be understood as a *"set of inter-organizational networks that bind firms and other subjects (states, trade unions, labour unions, households) into larger economic units"* (adapted from Sturgeon 2001, p. 2). Therefore, GVCs are basically linear and vertical structures that ultimately lead to the end-use of a given commodity. However, in reality the flows of material, (semi)finished products, information, know-how and finances form a complex, multidimensional and multilayered nexuses (Henderson et. al. 2002). Not only vertical, but also horizontal and diagonal flows constitute the inter-organizational networks. The concept of GPN is thus better able to grasp the organizational complexity and geographical variety of production networks, which are *"…inherently dynamic; they are always, by definition, in a process of flux—in the process of becoming—both organizationally and geographically. The spatio-temporality of production networks, therefore, is highly variable and contingent"* (Coe, Dicken, Hess 2008, p. 272).

It is vital to realize that specific value-adding activities (such as design, development, manufacturing of components, final assembly or marketing) are not necessarily concentrated into a single node of a value chain. For example, the conceptualisation of producer-driven value chains in the automotive industry may lead to a false presumption that design and development are placed at the "beginning" of the value chain or are performed only by lead firms – large car assemblers such as Škoda Auto in the case of the Czech automotive industry. On the contrary, in the case of Škoda's production network see Pavlínek, Janák 2007) we can see that design and R&D activities can be found in all supplier tiers including the third-tier suppliers of low value-added and less sophisticated parts and components (Pavlínek, Ženka 2011), even though the lower-tier suppliers are responsible for rather marginal part of R&D. Moreover, the principal R&D of the most sophisticated components (such as chassis, engines and transmissions) is being performed outside the Škoda's supplier network and outside Czechia – by the VW's headquarter in Wolfsburg, tier-one lead firm and the owner of Škoda.

b) Therefore, another crucial aspect of GPN is an emphasis on the firm's ownership as a significant factor influencing the prospects of industrial upgrading and the value capture potential of a host region. In GVC and early GPN literature the firm was treated as a black box, drawing on a bimodal distinction between a lead firm (or a flagship firm according to Ernst, Kim 2002) and a supplier firm, more or less subordinated to the lead firm. GPN provide more subtle classification of tiered structure of supplier firms in order to analyze the distribution of corporate power along the production network and evaluate its potential implications for regional development. Firm needs to be conceptualised as a relational network embedded into a larger set of interconnected institutions and organizations (Henderson et. al. 2002). The prospects of industrial upgrading of a TNC's subsidiary are thus heavily influenced not only by its insertion into inter-firm production networks, but also by its position in the hierarchical structure of parental TNC.

c) The GCC approaches have been concerned primarily with existing commodity chains and were thus rather ahistorical. However, the constitution and reconfiguration of value chains is a path-dependent process. Value chains are not formed in vacuum, they tend to reflect recent localisation pattern of major industrial centres, large firms with a long tradition, high levels of territorial embeddedness and also previous regional pattern of large investments into fixed assets – especially production plants. What is even more important, specific institutional context – e.g. governmental incentives, employment protection legislation, labour unions in old industrial centres may shape, stimulate or limit the creation of new value chains (Pavlínek, Ženka 2010). Thus, reconstruction of history may explain current spatial constraints for future trajectories of chain development (Henderson et. al. 2002).

GPN concept distinguishes three important dimensions of spatiality, which is considered to be crucial characteristics of GPN. Firstly, all forms of embeddedness have inevitably spatial character. Secondly, all GPN are multiscalar, interconnecting and operating at local, regional, national and global scale. Asymmetric distribution of corporate power, extra-chain governance such as governmental regulation or labour unions as well as territorial embeddedness bring the third spatial aspect – geographical boundedness of network-based activities in national or regional institutional context.

d) GPN also provide less deterministic framework for analysis of regional development implication of production networks. In GCC/GVC approaches, the position of firms in value chains to large extent determines the prospects of industrial upgrading and thus value creation and value capture potential of particular firms. The GPN perspective attributes relatively high level of autonomy to domestic firms and other network participants, such as labour and trade unions that have a potential to significantly influence economic and social outcomes of the production networks in which they are incorporated.

Both GVC and GPN concepts are relevant for the research of industrial upgrading in the automotive industry and its regional development implications. The GVC approach us useful for classification of basic factors influencing the distribution of value in the global value chain – input-output structure, chain governance, barriers of entry and related economic rent, distribution of power along the value chain, institutional context and spatial constraints (according to Gereffi 1994). GPN approach enables conceptualisation of the horizontal linkages in production networks, which heavily influence regional development potential impacts of domestic firms and TNC subsidiaries. Thus, GPN perspective is very useful for the analysis of impacts of institutional context on national and regional level, territorial embeddedness of TNCs and specific regional assets for the prospects of industrial upgrading and notions of value creation, capture and enhancement potential in selected host regions.

3. Value chains and production networks – regional development potential

In this section are two basic concepts tightly connected to industrial upgrading defined and discussed. Firstly, various conceptualisations of value are introduced and compared – value as an economic rent, value added and unit value of production and exports. Secondly, ability of regions to create, capture and enhance value through the process of strategic coupling is elaborated in the light of recent GVC/GPN theoretical literature.

3.1 Notion of value and value creation, enhancement and capture

For the purpose of this research value can be defined, understood and conceptualised in three different ways. First, we can refer to the notion of an economic rent (see Kaplinsky 1998), the concept which is necessary for the single definition and understanding of the process of industrial upgrading. Second, the unit value of exports and imports is the next possible approach to measure intensity of industrial upgrading and shift of national/regional economies to the quality-based competitiveness with significant regional development implications (see e.g. Aiginger 1997). Third, value may be understood also as a value added, revealing the presence and complexity of value chain and the portion of economic activity performed in a particular location compared to the financial value of imported materials and components (Porter 2004).

Value as an economic rent

Economic rent can be understood as a super-profit of an entrepreneur, who exploits either the production factors of above-average productivity[2] (fertile land, superior process technology etc.) or ubiquitous production factors more effectively than his competitors) and is able to prevent them from taping into the sources of his competitive advantage. Thus, the economic rent is an extra-surplus to the average rate of profit in a particular industry, which arises in the case of differential productivity of factors and unequal access to them (Kaplinsky, Morris 2001). Originally, Ricardo (1817) referred to the economic rent as an extra-payment from a farmer to the landlord for using the qualities of the soil. The source of this income was not the differential fertility of the soil itself, but the element of scarcity – caused by highly uneven distribution of land ownership (Kaplinsky, Morris 2001).

As Schumpeter (1961) pointed out, economic rent may originate not only from natural bounty, but may be purposely constructed by the entrepreneurial innovation activity (Kaplinsky 1998). New process, product, organization and other types of innovations generate super-profits as long as the revenue from an innovated product exceeds the innovation costs. Entrepreneurs yield higher rates of profit resulting from their temporary monopolistic position until the particular know-how leaks from the firm and the innovation is being absorbed, imitated and improved by the competitors (Kaplinsky 1998). Permanent innovation process leading to capturing super-profits (industrial upgrading) is thus a mean of escaping from *"the tyranny of competition and the normal rate of profit"* (Kaplinsky 1998, p. 10). Moreover, the temporary nature of this kind of innovation-based producer rent makes innovations necessary not only for reaping higher than average profits, but also for sustaining the competitive advantage in the long term. An average rate of profit in each industry is understood as an equilibrium (Kaplinsky 1998), which is permanently being distorted by the implementation and commercialisation of innovations. It is, however, very difficult to measure the economic rent of firms on the basis of comparison with industry average. For example, the automotive industry is a very heterogeneous network of companies of various size, capital and technology

[2] We refer to the „total factor productivity – TFP. *"Total Factor Productivity (TFP) is the portion of output not explained by the amount of inputs used in production. As such, its level is determined by how efficiently and intensely the inputs are utilized in production"* (Comin 2006, p. 1). Do not confuse it with the term "factor productivity" used in Pavlínek and Ženka 2011.

intensity. Extremely concentrated ownership structure is channelling the power and the profit into several large TNCs, which orchestrate a tiered structure of suppliers – from a limited number of large 1st-tier suppliers oriented on design and development of modules and complex automotive parts to hundreds of 3rd-tier suppliers collaborating on manufacturing of less sophisticated parts and components. It is thus unrealistic to expect an average rate of profit in the automotive industry. The distribution of profit is likely to follow the tiered structure of the automotive value chain and particular assemblers/suppliers should be compared to the other counterparts in their respective tier. Table 1 shows asymmetric distribution of profit along the Czech automotive value chain in the period of 2006-2008. While the lead firms (assemblers) concentrated 45.2 % of total gross operating surplus created in the broadly defined Czech-based automotive industry, their share in employment was only 18.8 %.

Table 1 Distribution of profit along the Czech automotive value chain (2006-2008)

	Share in automotive industry (%)					
Tier	**Employment**	**Turnover**	**Value added**	**GOS**	**Wages**	**GOS in value added** (%)
Assemblers	18.8	37.3	31.5	45.2	23.3	34.7
1st suppliers	25.1	23.7	25.1	19.3	25.8	18.6
2nd suppliers	27.4	20.3	22.5	21.1	25.2	22.7
3rd suppliers	28.8	18.8	20.9	14.5	25.7	16.7
Total	100.0	100.0	100.0	100.0	100.0	24.2

Notes: All numbers calculated as 3-years average value of 2006, 2007 and 2008; GOS=gross operating surplus; based on the database of 476 Czech-based firms in the broadly defined Czech automotive industry
Source: Czech Statistical Office 2010; Annual Survey of Economic Entities in Selected Industries

The emphasis on the distribution of wealth along the (global) commodity chain is characteristic for Hopkins and Wallerstein's approach as well as for Gereffi's GCC perspective. Hopkins and Wallerstein (1986) in their anatomy of a commodity chain distinguish boxes (separable activities such as R&D, production or logistics) and linkages connecting those particular boxes. According to their statement, the most important characteristics of any single box is the degree of monopolization of activities – to what extent is each box dominated by a small number of large companies/units of production and thus to what extent is core-like and provides the opportunities for creation of high profits. Hopkins and Wallerstein (1986) highlight the importance of demonopolisation of highly profitable boxes, redefinition of their organizational boundaries and shifts of capital investment towards more profitable boxes as one of the key processes in the capitalist economy. Rates of profit and the degree of monopolisation are affected by barriers to entry into a particular box/node (Kaplinsky, Morris 2001). Companies in a specific box try to increase the barriers of entry by permanent innovation of process and product technologies, organization methods, marketing and branding, leading generally to increasing capital/technology intensity or a skill content of production, higher entry sunk-costs (Clark, Wrigley 1995) and higher rate of entrepreneurial surplus.

However, entrepreneurial surplus arising from the innovation process is only one kind of an economic rent. Kaplinsky and Morris (2008) argue that an economic rent might be purposely constructed not only by the corporate sector, but also by other actors outside the narrowly defined value chains – such as national and regional governments or technology transfer institutions. They distinguish four basic families of economic rents – monopolistic, resource, internal and external rents.

Monopolistic rents arise from firm's ability to *"shape market relations, by building monopoly power and by using anticompetitive practices such as predatory pricing or cartels to exclude competitors" (*see Kaplinsky, Morris 2008, p. 300). These practises are, however, not so relevant to the case of the automotive industry, characterised by extremely concentrated "oligopolistic" ownership structure. Lead firms in the automotive industry (large assemblers such as Toyota or Volkswagen) derive monopolistic rents mainly not at the expense of their direct competitors, but at the expense of customers[3], suppliers[4] and also at the expense of national or regional governments, as these large firms possess significant bargaining power in terms of investment incentives.

Monopolistic rents are very important in oligopolistic industries, such as manufacturing of motor vehicles, especially in those cases, where they are reinforced by endogenous or exogenous rents. Lead firms may use their unique know-how and superiority in the field of technologies, marketing or branding as a source of monopoly rent. This is especially common in the case of lower-tier suppliers that are dependent on supplying relatively specific parts and components, when high transaction costs do not allow them to change and diversify their portfolio of customers (Sturgeon et. al. 2009). Product specificity connected to the requirements of technical compatibility increases switching costs and creates opportunity for the lead firms to exercise their corporate power and pressure the suppliers to lower prices.

The second family – resource rents – are derived from highly geographically unequal distribution of natural resources, which favours a small group of countries/regions that capitalize on abundant resource endowment. Resource rent is close to original conception of Ricardo (1817), who derived the concept of economic rents from the scarcity and unequal access to fertile land (Kaplinsky 1998). In the case of Czech automotive industry – as a technology-intensive industry, resource rents are not particularly significant. Even in the case of suppliers of material, such as steel or plastic granula for the suppliers of plastic stampings, rents are derived rather from scale economies and superior technology than from privileged access to natural resources.[5]

The third and fourth families of rent may be associated more directly with the process of industrial upgrading, as they refer to progresses in cutting production costs, enhancing the efficiency of the production process and introduction of innovative products. The distinction between endogenous and exogenous rents lies in the source of rents. While endogenous rents are created primarily by the corporate sector – either by an internal effort of firms or in intra-firms interactions as well as cooperation between firms and local R&D and technology transfer institutions. Endogenous rents can take a form of introduction of new process of product technologies, organisation innovations (such as outsourcing, total quality management), training of employees to learn new technologic/organisational principles, marketing innovations etc.

On the other hand, exogenous rents are being created by actors outside the narrowly defined value chains, such as national or regional governments. These actors may create the business environment which is favourable for all firms and contributes to fostering of their competitiveness, or enforces only some kind of subjects, such as large TNCs by introducing the investment incentives scheme favouring large investors or subjects in one specific industry by investing into the improvement of one specific branch of technical education.

[3] Lead firms abuse their dominant market position in home country and maintain higher prices in their home country than in other foreign markets - Škoda Auto in Czechia.

[4] Lead firms tend to abuse their purchasing and other kinds of power resulting from their coordination role in the value chain – so called chain governance (Humphrey, Schmitz 2000, 2002; Sturgeon 2001).

[5] Major suppliers of material are located in countries like Germany or Belgium – according to our interviews made in 2010

Kaplinsky and Morris (2008) highlight the importance of production factors and features of business environment that favours all economic subjects – such as efficient financial intermediation, developed transportation or telecommunication infrastructure.

The concept of economic rent is vital for understanding the essence of industrial upgrading (see section 4). However, as already noted above, economic rent cannot be empirically measured and directly calculated, because there is no such thing as a usual profit rate of a particular industry or a value chain. For example, the automotive value chain includes many suppliers from other manufacturing branches, exceeds national borders and the majority of suppliers are connected to more than one value chain. Therefore, it is not clear what group of firms or part of a value chain should be regarded as referential for calculating the normal rate of profit. Moreover, the development of profit rates exhibits high annual oscillations resulting from demand fluctuations, large investment projects and successful product and process innovations and the source of increased profit cannot be easily recognized. However, even the simple distribution of profit (gross operating surplus) among the individual tiers tells us much about the barriers of entry, power relations and sources of competitiveness in the value chain. For further methodological information see Kaplinsky and Morris (2001), who discussed the strengths, weaknesses and usability of various indicators based on profitability (such as return of equity) for the value chain analysis.

Value in terms of value added

From the regional development point of view the concept of value added can be very useful for measuring the industrial upgrading especially in terms of increasing complexity of firm's operations and a shift to higher value-added strategic activities. The (gross) value added is defined as the financial value of output less the value of intermediate consumption – purchases of materials, energy and services (OECD Glossary 2011). It can be calculated for a firm, industry, sectoral and state level, estimations can also be made for a plant and a regional level. The value added, which contributes to the creation of GDP, represents the share of production value created by internal firm's operation, using its own resources – labour force, machinery, technology and organizational know-how. While the value added itself does not tell us about the profitability of production activities and tax yield, compared to the concept of an economic rent, it has several advantages in terms of regional development implications:

- Value added fluctuates less than profits.
- Profitability is bound to factor rather than to an institutional level (Kaplinsky, Morris 2001). Value added includes wage costs as a portion of total value retained in the region. Profit, on the other hand, may be easily withdrawn from the particular region in a form of repatriation.
- Compared to an economic rent, value added may be easily measured and calculated both on the firm and the regional level.
- Transnational companies use transfer pricing in order to lower tax payments and thus may record very low profits or even losses in the long-term period.
- Value added and derived indicators, such as labour productivity and R&D intensity, are the best tools for quantitative measurement of industrial upgrading intensity in respect to regional development implications (Pavlínek, Ženka 2011).

Pennings and Sleuwaegen (2000), Ženka (2009) and Ženka and Čadil (2009) used the indicator value added in sales to measure the complexity of a firm's activities and the level of its vertical integration as factors strengthening location inertia. This indicator mostly reflects functional upgrading in terms of acquiring new (non)production strategic, technology or knowledge-intensive functions such as design, R&D or marketing. Very low levels of value

added in turnover (production, sales) are characteristic for firms and especially subsidiaries of TNCs in the lowest tiers of value chains, oriented on standardized, low value-added assembly activities. Bruinsma, Gorter and Nijkamp (1998) described "nomadic firms" combining assembly character of operations, labour-intensive production, low capital investment and low levels of embeddedness into regional economy and therefore high probability of relocation. Pavlínek and Ženka (2011) used value added in turnover only as a supplementary indicator and highlighted its major weakness – it is heavily influenced by the capital intensity of production.

Moreover, the share of value added in turnover is generally influenced by technological and organisational specificity of particular industries. For example, the automotive industry is characterised by an extremely concentrated ownership structure and a strong dominance of lead firms (assemblers) over the hundreds of component suppliers. While the assemblers exhibit extraordinarily high levels of profitability compared to the majority of suppliers, the share of value added in turnover is very low (see Table 1). The reason lies in very high capital intensity of production process and also in high levels of outsourcing, where the majority of components, with the general exception of motors, chassis and gearboxes, are sourced from the first-tier suppliers, which further coordinate branched structure of lower-tiered suppliers.

Value in terms of unit value of exports

Aiginger (1998) defines the unit value as nominal value of sales (exports) divided into quantitative measure, usually kilograms. More specifically, he uses an equation derived from the Cobb-Douglass production function $Q = A.L^{\alpha}.K^{\beta}.M.$, where *Q,L,K and M* are quantities of output, labour, capital and material input, adds P for an output price and distinguishes between M_w and M_u, material not embodied in the final product (waste) and material embodied in the final product. Unit value is defined as $UV = P.Q/M_U$ – nominal export output per material embodied in the final product and may be calculated for imports and in case of data availability also for production. Aiginger (1997, p. 572) mentioned the proximity to the concept of partial productivity – both concepts express outputs per unit of inputs (difference is in denominator, containing material instead of labour or capital). He highlights that unit value is more quality oriented, incorporating quality elements such as embodied technologic progress, level of sophistication and services enhancing the final price.

Therefore, the unit value is appropriate for measuring the quality and sophistication of final products, while labour productivity (value added per an employee) and capital productivity (value added per a unit of tangible assets) are related to institutional level (measured for firms producing various commodities) and reflect more significantly the specificity of the production process[6]. Partial productivity is thus a vital indicator of competitiveness and allows us to measure combined effects of product, process and functional upgrading on the level of particular companies, regions or value chain nodes (see Pavlínek, Ženka 2011).

On the other hand, unit values may reflect indirectly not only the level, but also the sources of international competitiveness. Aiginger (1997, p. 575) combines this indicator with the balance of external trade in order to split between price competitiveness and technological competitiveness. Low unit value price and trade surplus reveal the cost-based comparative advantage. In case of capital-intensive (resource-based) industries with low value-added in turnover the final price (e.g. cement or steel) could be almost equal to the unit value price. In case of technology (especially electronics, IT) and some marketing-intensive industries, the unit value price is much higher than market price, reflecting embodied technological progress,

[6] Capital, technology and labour intensity, efficiency resulting from organizational innovations.

sophistication, marketing and branding. High unit values of export combined with trade surplus indicate the quality-based competitiveness – either in terms of technological superiority, efficient organization of production, successful marketing or branding.

Kaplinsky and Readman (2005) further developed this approach in order to measure the intensity of industrial upgrading on the country level. They introduced a "product upgrading quotient" (PUQ index), used also by Fink (2005), who defined it as

$$PUQ = dP\%X + \Delta MSX$$

where:

PUQ is a composite index, which reflects changes in both unit prices and market share of a country X in a group countries (e.g. OECD, EU) in particular industry; **dP%X** is a deviation of the percentage change in unit price between Year 1 to Year n for country X from the average percent change of unit price between Year 1 and Year n for the particular industry and Δ **MSX** is the change in market share of country X between Year 1 and Year n. Product upgrading is thus defined as increase in both unit price and market share, downgrading vice versa (Table 2).

Table 2 Unit value and market share as indicators of product/process upgrading

	market share decreases	**market share increases**
unit value rises relative to industry average	*sector 2* **failed product upgrading** or failed process upgrading	*sector 1* **product upgrading**
unit value falls relative to industry average	*sector 3* **product and process downgrading** unattractive sector/high exit barriers/structural burden	*sector 4* **process competitiveness** or falling production costs/ immiserising growth

Source: Aiginger 1997; Kaplinsky and Readman 2005; Fink 2005

The combination of market share increase and falling unit value prices may reflect upon the increasing international competition in the particular industry and introduction of successful process innovations, when the economic rent is moving from the producer to the customer (Kaplinsky 1998). However, this situation may also be the result of decreasing production prices (e.g. fluctuations in prices of fuels) and static innovation or worse, the process of immiserising growth[7]. Situation in sector 2 (Table 2) generally signalizes deficit in price competitiveness, but the reasons may be ambiguous (Fink 2005). Failed product upgrading means inability to move to higher value-added products in order to cope with increasing international price competition, especially in labour-intensive industries. However, market share decrease combined with rising unit value prices may be the result of low productivity and thus failed process upgrading, no matter whether the product upgrading itself is successful or not. Final price of exported products could be pushed up by unfavourable development of exchange rates, rising prices of production factors (material, energy, labour

[7] Based on the original concept by Bhagwati (1958), Kaplinsky (2004) defined immiserising growth in an open economy as an increase in economic activity/export associated with decrease in real live standards. More specifically, immiserising growth occurs when the fall in barter terms of trade (average import price divided by average export price – thus how much imported goods can you buy for a unit price of exported goods) is not compensated by increasing income terms of trade – in other words when decline in prices of exported goods exceeds the increase in demand.

force) or inability to reach scale economies because of small domestic market (Kaplinsky, Readman 2005).

Table 3 shows main strengths and weaknesses of unit value as a concept and indicator for measuring the intensity of industrial upgrading. Unit value is generally suitable for international comparisons of both price and quality based competitiveness as well as for measuring the intensity of product upgrading in longer time series. Compared to the sectoral structure of exports according to technology-intensity, unit values provide more subtle and sensitive information about real sophistication and embodied technological progress in a particular product. For example, there are significant differences in complexity and sophistication of automotive components and modules within the product groups (Pavlínek, Domanski, Guzik 2009). Even the unit values of exported technology-intensive products such as engines may significantly differ as some countries export the most technologically advanced engines for expensive cars and other countries export rather obsolete engines for run-out models. There is also another advantage – unit values allow us to measure the industrial upgrading on the product level, while the value added is available only for company and industry level. Therefore, the results are not so blurred by various economic activities of companies, which often tend to be integrated into more than one value chain and supply several customers in various industries. Moreover, Sturgeon and Gereffi (2009, p. 7) argue on the example of successful industrial upgrading in Korea and Taiwan that *"specific products, rather than broad industries, have been key to upgrading in these countries (e.g. microwave ovens from the Republic of Korea, not white goods in general; computer monitors from Taiwan Province of China, not electronics in general)"*.

Table 3 Unit value as an indicator of industrial upgrading – strengths and weaknesses

	Strengths		Weaknesses
+	International comparability, data available for long time-series	-	Unavailable for company/local/microregional level, rarely for NUTS2/NUTS3 level
+	Reflects both price and quality-based competitiveness	-	Provides almost no information about the position in a value chain, production process, complexity of firm's operations, presence of strategic (non)production functions, regional embeddedness and technology-intensity of production in a particular region
+	Allows to measure and to certain degree separate the effect of product upgrading from other types of industrial upgrading	-	Provides no information about value captured in region, less applicability for measuring regional development implications
+	Suitable for measuring industrial upgrading in developing economies	-	Ambiguity (distorted by transfer pricing, exchange rates, rising production costs), may hide immiserising growth
+	Available for product level (value added is available only for industry and company level)	-	Requires homogeneity of products (rising unit value may not result from innovations, but from abandoning production of low unit value)
+	Reflects real technology-intensity and sophistication of exported products (more sensitive than structure of exports by technology-intensity)	-	Many companies primarily serve domestic market and products are thus not exported

Source: Aiginger 1997; Fink 2005; Kaplinsky, Readman 2005; Pavlínek, Domanski, Guzik 2009; Pavlínek, Ženka 2011; Sturgeon, Gereffi 2009

Unit value allows, to a certain degree, to distinguish among product, process and functional upgrading. While value added reflects all processes and all kinds of innovation in a firm or industry (including improvements in organization of production, introduction of new technologies, marketing and management practices, own R&D), unit value primarily reflects the intensity of product upgrading. Along with data availability and the possibility of product

level analysis, it is one of the most important advantages of this approach, but also probably the greatest disadvantage. Technological content is embodied not only in exported products, but also in imported components and production equipment (Sturgeon, Gereffi 2009). Developing countries moving to low value-added assembly of technology-intensive products will thus exhibit sharply rising unit values of exports, but value added and captured in a particular region can stay on a very low level.

Rising unit value prices of exported products may hide or distort the specifics of production process, because in many cases the capital/labour-intensity of production is a result of strategic managerial decision, rather than an intrinsic property of the product (Antras, Helpman 2004). Unit value does not tell us anything about the technology-intensity of production, presence of strategic (non)production high value-added functions (such as design, R&D, marketing), regional embeddedness, position in a GPN with respect to the ownership relations and generally how much value is created and captured in a particular region (Pavlínek, Ženka 2011). This problem can be, to a certain degree, solved by the comparison of quantities and unit values of exported and imported products – low value-added assembly character of operations may be thus identified by the calculation of trade balance and barter terms of trade. There are however several methodological issues and distortions. For example, in case of the automotive industry, each supply chain contains hundreds or even thousands of suppliers from various industries such as metallurgy, machinery or electronics. No classification of exported products provides sufficiently detailed data to capture all purchases of assemblers and especially FTSs and even if it did, there would be serious problems resulting from extraordinarily complex and branched structure of the automotive value chain. It is not possible to calculate the quantity and unit value of import in product categories (automotive components) and then compare such a sum to the export of automobiles or modules in order to obtain information about the local content. Moreover, a certain portion of imported goods is used for the local market, not for re-export. In conclusion, unit value of exported goods is a useful indicator for measuring the product upgrading and international competitiveness. It is, however, unsuitable for measuring the regional development effects of a particular FDI.

3.2 Value creation, enhancement and capture potential

According to the conceptualisation of Coe et. al. (2004, p. 469), we may define the regional development as *"a dynamic outcome of the complex interaction between territorialized relational networks and global production networks within the context of changing regional governance structures"*. This relational view emphasizes not only the importance of extra-regional factors of regional development – large TNCs and global production networks orchestrated by them, but especially the complementarity of regional assets and strategic needs of TNCs. The GPN perspective considers the indigenous regional assets and institutions to be a vital, but not sufficient source of regional economic growth and competitiveness (Yeung 2009a). Amin (1999, p. 375) argued that for a successful economic growth, the ability of places to anticipate and adapt to changing external conditions is more important than the simple presence of local relations and institutions. Insertion of regions into global production networks has to be based on the possession and development of regional assets that correspond with the strategical objectives of TNCs.

Regional development thus may be understood as a strategic coupling between strategic needs of TNCs and regional assets, mediated by the role of institutions on a local, regional and also national level (Coe et al. 2004; Yeung 2009b). The position of a region in the global production networks, type and intensity of strategic coupling[8] is crucial for creation

[8] This topic is elaborated in Pavlínek and Ženka (2011).

and retention of value and thus for the prospects of regional development (Coe et al. 2004; Henderson et al. 2002). In order to evaluate regional development effects of the insertion of firms into GPNs, these authors have introduced three conceptual categories – value creation potential, value enhancement potential and value capture potential.

According to the conception of Henderson et. al. (2002) two significant issues regarding the **value creation potential** include *"...the conditions under which labour power is converted into actual labour through the labour process; and the possibilities for generating various forms of rent"* (Henderson et. al. 2002, p. 448). Based on this assumption it is possible, for the purposes of this thesis, to distinguish between two basic dimensions of value creation potential on the regional level. The first dimension includes regional factor endowments which are necessary for the attraction, establishment and development of value added activities generating "normal profits". The second dimension refers to the creation of "supernormal profit" in the form of various kinds of economic rent and is thus tightly connected to the processes of value enhancement and industrial upgrading. In reality, these categories are inseparably interconnected and the stimulation of economic activity promising generation of supernormal rate of profits is a regional imperative.

The *first dimension* includes the combination of basic "hard" location factors (geographical location, pool of accessible and adequately skilled labour force, proximity to suppliers and customers, technical and transport infrastructure, supra-regional and regional transportation links, proximity to universities and research centres – see Eickelpasch et. al. 2007), and soft location factors such as attempts of regional institutions to attract value-added activities through various investment incentives, supporting firm start-ups and promoting supplier networks, (re)training workforce and encouraging venture capital formations (Coe et. al. 2004; Phelps, Raines 2003). Bowman and Ambrosini (2000) argued that not all labour can be a source of super-normal profits. They distinguish between generic, differential and unproductive labour force. Generic labour is homogenous across competing firms and is based on generic skills, codifiable know-how and rather routine activities.

Walter, Ritter and Gemünden (2001) described another mechanism especially relevant to the creation of value in the automotive industry – supplier-customer relationships. They distinguished between two types of value creation/revenue effects from the viewpoint of suppliers – direct and indirect value functions. In the first, case supplier's profits are derived from the dyadic customer-supplier relationships and include "profit function" (relative direct revenue obtained from the customer); "volume function" (volume of contracts from the customer) and "safeguard function" guaranteeing certain level of business and revenue from the customers (see also Möller, Törrönen 2003, p. 110). In the latter case, the value creation effects are indirect and more difficult to measure, because the revenue originates from the insertion into a broader network of actors such as universities and research institutions, final markets or other competing customers. Möller and Törrönen (2003) recognize four kinds of effects of "innovation function", referring to stimulation of product and process innovations, "market" and "scout" functions bringing the possibilities of accruing new customers through the reference impact of collaboration with particular customers and also obtaining information about new markets and finally "access function", which enables suppliers to find and launch collaboration with new actors on the (supra)regional level. Indirect value functions are thus close to the concept of strategic coupling (Young 2009a, Young 2009b) and may involve both the creation of super-normal profits and value enhancement processes.

The *second dimension* of value creation potential (ability to gain economic rents) is inseparably interconnected with the **value enhancement potential**. While the former provides information about current conditions for value creation, the latter refers to the prospects of industrial upgrading – a dynamic process of shifting to more profitable and higher value-added activities. It is, however, difficult to imagine the case in which a region sustains its

value creation potential for a longer period, without the processes of value enhancement. Based on the classification of economic rents by Kaplinsky (1998), Henderson et. al. (2002) highlight the importance of technological, organizational, relational, brand and trade-policy rents, derived from the asymmetrical access to product and process technologies, advanced organizational models and managerial skills such as just-in-time mode of production, mutually beneficial supplier-customer relationships/technological alliances or collaboration within clusters, successful branding and unequal access to the incentives provided by protectionist trade policies.

Coe et. al. (2004) argue that regions need not necessarily create all forms of rent. On the contrary, regions should specialize according to their specific mix of factor endowments and (supra) regional institutions, that together create a unique set of regional assets. What is important, not only metropolitan and highly developed regions with flexible labour market, wide range of skills and efficient pro-growth coalition of institutions may acquire some kind of economic rents. There are also possibilities for peripheral areas and regions with structural burden, in which TNCs may capitalize on an abundant supply of cheap labour force and reap the scale economies. However, the value enhancement potential is primarily connected with the issues of technological transfer between various actors both within and outside the particular GPN and both within and outside the boundaries of the respective region. Henderson et. al. (2002) emphasize the importance of technology/knowledge transfer between the lead firms of GPNs and their suppliers, which may be pushed by the lead firms to enhance the productivity of a production process, increase the technological content and sophistication of the components or to be able to provide more complex range of production services, including the collaboration on design and development of products. Processes of value enhancement through technology and knowledge transfer are stimulated by the complementarity of know-how between TNCs and local SMEs inserted into GPNs (Chew, Yeung 2001, p. 433). Together with increasing demand for the skill content of a production process and the ability of local firms to create organizational, relational and brand rents on their own, these aspects of value enhancement correspond with the concepts of product, process and functional upgrading.

However, as Henderson et. al. (2002, p. 449) put it, one thing is the creation and enhancement of value in a particular location and another thing is whether this value is truly captured for the benefit of this location. Again, the issue of **value capture** is inseparably connected with the value enhancement potential. Coe et. al. (2004, p. 475) argue that *"…regional institutions may promote specific 'regional assets' (e.g. cooperative industrial relations) that are conducive to high value-added production activities because these activities incur high costs of fixed investment (i.e. sunk costs) and are difficult to be relocated within a short period of time."* This statement clearly demonstrates tight causal relationship between industrial upgrading and location inertia as a necessary precondition for value capture. Nevertheless, apart from sunk-costs and regional embeddedness as factors strengthening manufacturing location inertia, there are other important mechanisms through which economic rents can be transferred to another region. Generally, two important ways through which profit may be withdrawn from the region, may be distinguished – physical relocation of value adding activities from the region and repatriation of profits by home companies through.

Lepak, Smith and Taylor (2007, p. 181) use a term "*value slippage*" to describe the process when value created by one source or on one level is captured by another. They distinguish three different levels of value creation and retention – individual, organizational and societal[9] level (Table 4). On the organizational level, they show value creation process

[9] For our purposes the societal level may be substituted by the regional level.

based on a continual innovation, knowledge creation and application of R&D, which is followed by value capture in terms of appropriation and protection of rare, inimitable and intangible resources. They also identified two basic processes of value slippage from the organizational (in our case TNC) to the individual (customers) and societal/regional level.

In the first case it is necessary to distinguish between use value and exchange value. According to Bowman and Ambrosini (2000), use value refers to specific features and qualities of a product – therefore, how the product fits into customer's needs and requirements – such as comfort, spaciousness or acceleration rate of a car. Exchange value *"... is the monetary amount realized at a single point in time when the exchange of the good takes place. Perceived use value can be translated into monetary terms: it can be defined as the price the customer is prepared to pay for the product if there is a single source of supply"* (Bowman, Ambrosini 2000, p. 3). These authors also argue that only in rare case of a monopoly will be the use value equal to the exchange value paid by customer, in all other cases the customer will pay less. Therefore, he will gain a "*consumer surplus*", understood by Whitehead (1996) as a "*value for money*". In the automotive industry, the relationship between suppliers and final consumers are not so important for the question of value capture potential of host regions. What matters more, is the bargaining power of large lead firms[10], allowing them to pressure suppliers to lower costs at the expense of their margin (Humphrey, Schmitz 2002).

Table 4 Dimensions of value creation/capture according to Lepak, Smith, Taylor (2007)

TABLE 1
Dimensions of Value Creation

Level of Analysis or Source of Value Creation	Academic Lens	Target or User of Value	Creation Process	Value Capture Process	Article
Society	• Sociologists • Economists • Ecologists	• Individuals • Organizations • Government	• Innovation and new firm creation • Competition • Capital investment • Incentives • Laws and regulations	• Factor conditions • Demand conditions • Supporting industry infrastructure • Firm strategy and rivalry	Lee, Peng, & Barney
Organizations	• Strategic management • Organization theory • Strategic HRM	• Consumer • Society	• Invention • Innovation • R&D • Knowledge creation • Structure and social conditions • Incentives, selection, and training	• Rare, inimitable, nonsubstitutable resources • Intangible resources	• Sirmon, Hitt, & Ireland • Kang, Morris, & Snell • Priem
Individuals	• Psychology • Organizational behavior • HRM	• Consumers • Client • Organization	• Knowledge creation • Search • Ability • Motivation • Training	• Network position • Unique experience • Tacit knowledge	Teppo & Hesterly

Note: Dashed arrow (⋯→) indicates value slippage; solid arrow (→) indicates value capture.

Source: Lepak, Smith, Tayor 2007, p. 1982

Therefore, value may be withdrawn also from regions hosting primarily domestic-owned companies, which are integrated into GPN and indirectly controlled by lead firms. Value slippage process of this kind is, however, hardly traceable and in fact is not so relevant for the case of the CE automotive industry, which is almost completely dominated by foreign capital. Moreover, Czech suppliers are usually plugged into several production networks in various industries (Pavlínek, Ženka, Žížalová 2011), which reduces their vulnerability and provide opportunities for value enhancement through continual functional upgrading

[10] For the case of the Czech automotive industry see also Pavlínek and Ženka (2011).

(Humphrey, Schmitz 2004). Probably the most important factor influencing the prospects of regions in capturing of value is thus the rate of external control of regional economic activities exercised by large TNCs. The issues of ownership, corporate strategies, the role and the position of a plant in the GPN/hierarchical structure as well as nationality of TNCs are thus highly relevant indicators and predictors of regional value capture potential (Dicken 1976; Massey 1979; Ferdows 1997; Meijboom, Voordijk 2003).

Dicken (1976) elaborated the importance of external control through ownership by TNCs located outside a particular region and highlighted three potential problems for regional development connected with the reinforcement of external control – repatriation of profits of TNC's subsidiaries outside the region, reduction of local supplier relationships and also emigration of skilled labour force. He distinguished between *potential control* (resulting from the ownership of more than 50% of equity share capital and *actual control*. Moreover, he also showed three different types of interdependence relationships between headquarters and subsidiaries – pooled, sequential and reciprocal interdependence (see Dicken 1976, p. 45). Pooled interdependence is characteristic by little or no direct connection between production units that are usually specialized on the production of one particular product. In the case of sequential (unidirectional) interdependence the output of one unit is an input of another unit, while reciprocal interdependence adds mutual relationships between headquarters and subsidiaries and between particular subsidiaries. The complexities of relationships and also difficulties with co-ordination of economic activities are increasing from the pooled to the reciprocal interdependence. The latter type thus requires exertion of tougher control, because of high level of complexity and contingency of transactions.

Although there is no causal mechanism between the level of actual control and the probability of profit repatriation, value capture potential may be significantly affected by the type of relationships between headquarters and subsidiaries. Pavlínek (2004, p. 61-62) used the case of the Czech-based foreign-owned automotive firms such as PAL Praha or Temac Zvěřínek to describe the conglomerate model of TNCs, where the subsidiaries are specialized in the development and production of a single class of components exported worldwide. In this case the owner has no expertise in the branch of a subsidiary, therefore *"…there are no attempts to transfer the existing R&D abroad, and some companies have experienced growth in R&D conducted in the Czech Republic after foreign acquisition"* (Pavlínek 2004, p. 61).

Therefore, these subsidiaries are relatively autonomous in terms of product development and specification, innovation, marketing and selection of suppliers. Technologies and knowledge created by the subsidiaries are not transferred abroad, but used for upgrading of processes and product innovation in the host region. Embodied technological progress, profit reinvestments and the possibility of maintaining long-term relationships with local suppliers and institutions provide favorable conditions for value capture. On the other hand, parental companies of the conglomerate type usually do not possess necessary know-how/technologies and rarely intend to actively co-ordinate the production activities of their subsidiaries in the long-term perspective. More often they only acquire companies in order to broaden their investment portfolio and make short-term profit after their restructuring and selling. Thus, this type of investment may be susceptible to changes in ownership and repatriation of profits abroad.

This distinction is, however, not so relevant for the Czech automotive industry. According to the results of our survey among 274 Czech-based automotive firms in 2009, the majority of foreign-owned subsidiaries are totally controlled by their owners, who actively orchestrate their production and financial activities. Therefore, while the degree of external control could be regarded as one of the most important factors influencing the prospects of regional value capture, corporate strategies may have ambiguous and hardly predictable impacts on regional wealth.

4. Industrial upgrading

Process, through which firms, regions and countries move to the upper parts of value chains/production networks, from peripheral to the semi-peripheral and core position, is called industrial upgrading. Humphrey and Schmitz (2002) consider upgrading as a necessary precondition for producers in developed countries to keep their competitiveness face to face with increasing pressures of imports from lower-cost countries. For producers in high-cost locations is vital to *"either increase the skills content of their activities and/or move into market niches which have entry barriers and are therefore insulated to some extent from these pressures"*(Humphrey, Schmitz 2002, p. 19). On the country level upgrading can also be understood as a shift from the factor-driven (cost-oriented) to efficiency-driven and innovation-driven stage of competitiveness (Sala-i-Martin, Artadi 2004). While industrial upgrading is generally connected to the shift to the upper parts of value chains/production network, knowledge-intensive strategic (non)production functions generating higher value added, increasing skill content of activities and shift to the production of more complex, sophisticated and expensive products, these processes should be understood only as manifestations or symptoms of upgrading, not as upgrading itself (Kaplinsky 2000).

Industrial upgrading should be thus defined as innovating in order to increase value added (Giuliani, Pietrobelli, Rabellotti 2000) or as a complex of innovations, which improve the competitive position and profitability of a particular firm compared to its main rivals. Upgrading always includes innovation process, but not all innovations are upgrading – see Table 5. Kaplinsky and Morris (2001, p. 37) argue that the concept of industrial upgrading *"explicitly recognises relative endowments, and hence the existence of rent"*. Therefore, innovation activities leading to entry into a segment of value chain with high entry barriers and the creation of economic rent can be regarded as the very essence of industrial upgrading (Gereffi 1999; Humphrey, Schmitz 2000; Kaplinsky 1998; Kaplinsky, Morris 2001).

Table 5 What is and what is not industrial upgrading?

What is/can be industrial upgrading?	What is NOT (necessarily) industrial upgrading?
innovation leading to higher productivity of production/profitability	innovation NOT leading to higher productivity of production/profitability
innovation improving firm's position (profitability, competitiveness) compared to rivals	routine product or process innovation
product downgrading leading to higher profitability - move to lower parts of value chain/production of less complex products	move to upper parts of value chain
abandonment of ineffective R&D or marketing in order to increase competitiveness	move to production of more complex and sophisticated products
sidestepping - e.g. entering into low-end sector in order to diversify product portfolio	increasing the skill content of activities
performing activities better than main competitors	performing activities better than before

Source: Bair, Gereffi 2003; Gereffi 1999; Giuliani, Rabelotti, Pietrobelli 2005; Humphrey, Schmitz 2000; Kaplinsky 2000; Kaplinsky, Morris 2001; Meyer-Stamer 2004; Porter 1990

Meyer-Stamer (2004) argues that upgrading is a shift to more profitable activities and functions, not necessarily a shift to more complex technology and knowledge-intensive activities with higher skill content. Rabellotti (2001) empirically documents voluntary upgrading of German shoe producers facing harsh competition, who abandoned their design and marketing functions to become subcontractors of Italian luxury brands – upgraded products by downgrading their competences. Especially for the case of manufacturing industries in transitional countries (including CE and Czech automotive industry) it is vital to

realize that upgrading is not necessarily connected with a shift of firms, industries and regions to the upper part of value chains/production networks. Firms may upgrade their production activities to maintain their competitiveness and occupy the same position in value chains even for a long period.

This could be especially true for captive value chains, characterized by highly asymmetric distribution of power, competences and also profit between the firms on the top and the suppliers on lower parts of GVCs/GPNs (Sturgeon 2001; Gereffi, Humphrey, Sturgeon 2005). In these networks, which are typical for technology and capital-intensive industries including the automotive industry, the lead firms exercise a great degree of control and may prevent their suppliers from functional upgrading and in some cases also from shift to the production of more complex products – generally they discourage suppliers from tapping into the source of their competitive advantage (Smith et al. 2002; Humphrey, Schmitz 2004; Isaksen, Kalsaas 2009).

The automotive value chain is organized into four basic tiers – assemblers as the lead firms on the top, first-tier suppliers oriented on manufacturing of complex and sophisticated components and modules, second-tier and finally third-tier suppliers oriented on the production of low-cost and less sophisticated components. As Pavlínek and Janák (2007), Rugraff (2010) as well as Pavlínek and Ženka (2011) show on the case of the Czech automotive industry, for the Czech-owned suppliers it is very difficult to enter the group of first-tier suppliers, which is almost totally dominated by the subsidiaries of large TNCs. Domestic-owned firms in transitional countries thus generally occupy lower part of value chains/production network, which does not mean, that they are not able to upgrade their production activities and stay competitive. Pavlínek and Ženka (2011) empirically document continuous improvements of the Czech-owned manufacturing firms that are able to survive and even expand their activities despite their general inability to move into higher parts of the automotive value chains.

4.1 Process, product and functional upgrading – the case of the Czech automotive industry

Humphrey and Schmitz (2002) distinguish between process (introduction of more efficient production methods and better technology), product (shift to the production of higher value-added products), functional (acquiring strategic functions generating higher income) and inter-sectoral upgrading (expansion to new and more profitable sectors).

Process upgrading is probably the most widespread type of upgrading, because permanent technology and organization innovations are necessary for surviving of both assemblers and suppliers at all positions of the value chain in the highly competitive automotive industry. Lead firms of the automotive production networks (major assemblers) stimulate process upgrading of the suppliers by introducing new technological modes of production (e.g. modular production), new organization models, quality standards and costs reduction requiring incremental improvements in the production processes (Womack et. al. 1990). These premises were empirically verified by Pavlínek and Ženka (2011), who argue that process upgrading took place in almost all Czech automotive suppliers between 1998 and 2006 and led to a significant increase in productivity, capital and technology intensity of production. A comparison of apparent labour productivity (gross value added per employee) of the automotive industries in selected EU countries revealed the significant convergence of Czechia and other CE countries to the Western European standards of productivity and profitability. These results were confirmed by 90 interviews conducted in 2009, 2010 and 2011 among both Czech and foreign-owned companies – managers argue that competitiveness of the Czech suppliers is comparable to the foreign suppliers. Process upgrading can thus be regarded as a vital precondition for firms to keep their competitiveness.

However, improvement in process technologies and organization is generally not sufficient to overcome the differences between core and peripheral regions in the automotive production networks.

Product upgrading among assemblers is generally manifested as a shift from the assembly of small and cheap cars towards the production of larger and more expensive cars. Production of top-of-the-range models characterised by a high level of technology complexity has been traditionally concentrated in the European core regions, while the production of small cars exhibits more dispersed spatial pattern with a significant share of the peripheral regions on the overall production (Lung 2004). However, large FDI into the assembly of expensive[11] models in some pericentral and even peripheral regions and continuing production of small cars in central regions impeaches this simplistic core-periphery pattern. Moreover, rising share of luxurious cars in production and exports does not tell us anything about the capital/technology intensity, skill content, value creation and local content of the production process. The orientation of some CE regions on the low-volume production of luxurious, niche (e.g. cabriolets) and sport models can rather be understood as an indicator of peripheriality, because it is often an export-oriented, low-value-added and labour-intensive greenfield assembly from imported components with various levels of local sourcing. *"In this type of production, shop-floor flexibility is not derived from technologically intensive flexible production methods, but from labor flexibility. Therefore, the cost of labour must be low enough to achieve efficiency and the labour must be highly flexible in order to accomplish rapid changes to new products"* (Pavlínek 2002, p. 1702).

Among suppliers, product upgrading can be defined as a shift towards the production of more complex, sophisticated and higher-value-added components, parts or even modules (engines, transmissions, steering and braking systems). Again, increasing specialisation of CE automotive industry on the production and export of higher-value-added components[12] provides no information about the skill content, technology intensity, productivity or regional embeddedness of the production operations and does not tell us how much value is generated and added in a particular host region.

Functional upgrading thus seems to be the most important mechanism through which the Czech automotive industry moves to the semi-peripheral position. The existence of strategic knowledge-intensive (non)production functions generating high value-added (design, R&D, logistics, marketing, accounting etc.) is a crucial indicator of the position in the value chain (Meijboom, Voordijk 2003).

Determinants of functional upgrading

Dynamics of functional upgrading of the automotive firms is strongly influenced by the type of the value chain they are part of and their position in it (Humphrey, Schmitz 2002). Gereffi et. al. 2005 identified five basic types of value chain governance; 1) *market* linkages, governed by price and characteristic by standard products, competent suppliers and low switching costs; 2) *modular* linkages, combining complex transactions based on codified knowledge and competent suppliers; 3) *relational* linkages, where buyers and highly competent suppliers tightly cooperate and exchange tacit knowledge; 4) *captive* linkages, characteristic by less competent suppliers which are tightly controlled and provided with detailed instructions; and 5) *hierarchies* – linkages within the same corporation. The automotive industry is an example of a captive value chain (quasi-hierarchical according to Humphrey, Schmitz 2000), characteristic by highly asymmetrical distribution of power between the lead firms (major assemblers) and lower-tier suppliers especially in less

[11] Porsche Cayenne in Leipzig, VW Phaeton in Dresden, Audi TT in Györ, VW Touareg in Bratislava

[12] The best example is Hungary with 58.4% share of high-value-added components in total exports in 2006 resulting from the specialisation on the assembly of engines (Pavlínek, Ženka, Žížalová 2010).

developed countries, high complexity of transactions based on codified knowledge and also high level of control over suppliers in the value chain. *"This level of control can arise not only from the lead firm's role in defining the product, but also from the buyer's perceived risk from the suppliers' performance failures. In other words, there are some doubts about the competence of suppliers in the chain."* (Humphrey, Schmitz 2004, p. 351).

Insertion in captive value chains stimulate process and product upgrading of the automotive suppliers but may hinder functional upgrading – especially in the 2nd and 3rd tier. *"Lead firms may encourage process and product upgrading but discourage functional upgrading of their suppliers to prevent them from moving into core competency areas of lead firms, such as design and marketing, which are their greatest source of value capture, and which usually remain located in the core areas of the global economy"* (Pavlínek, Ženka 2011, p. 563, see also Isaksen, Kalsaas 2009; Humphrey, Schmitz 2000, 2002, 2004). Increasing sophistication and complexity of automobiles together with introduction of lean production (characteristic by high organizational and logistic requirements) forces the lead firms (major suppliers) to co-operate only with limited number of 0.5- and 1st-tier suppliers. These systemic integrators are not only responsible for the assembly of parts and components into modules/component systems (dashboards, doors, cockpits, braking and steering systems etc.), but also for the coordination and management of 2nd-tier suppliers (Humphrey, Memedovic 2003). Pavlínek and Ženka (2010) document highly selective nature of functional upgrading (in the form of development of R&D functions) in the Czech automotive industry between 1998 and 2006. Only one fifth of analyzed firms exhibited increase in R&D intensity and ten largest firms accounted for 79% of the total R&D expenditure between 1998 and 2006.

Moreover, functional upgrading of the suppliers in the lower tiers of the value chain is limited, because these firms are oriented on the production and development of highly firm-specific components according to the design requirements of major customers. Customer-specificity increases transaction costs and makes potential shift to new products, technologies and customers more difficult. Smaller suppliers have to develop the competence by themselves or through co-operation with other small firms (Isaksen, Kalsaas 2009). High entry barriers and risks associated with the introduction of new products/ technologies and incorporation of higher-value-added strategic functions together with steep information asymmetry in the automotive value chain thus limit the prospects of functional upgrading of the 2nd and 3rd-tier suppliers.

However, there are some arguments for more optimistic view of possibilities of functional upgrading in captive value chains. First, tight control and co-ordination of the quasi-hierarchical value chain is associated with high transaction costs for the lead firms (Humphrey, Schmitz 2002). The need for tight co-ordination results from low competences of suppliers in product design, necessity of close monitoring and control to ensure that products and processes meet quality requirements and sometimes from the need of lead firms to help their suppliers to upgrade. The higher is the competence differential between the lead firm and supplier, the higher associated risk of supplier failure (Humphrey, Schmitz 2004). The shift to more relational coordination of supply chain may thus reduce risks and transaction costs.

Second, Humphrey and Schmitz (2004) also conclude that chain governance is a dynamic process and the power is relational – thus exercise of power[13] by lead firm depends on powerlessness of suppliers. However, suppliers may acquire new competences through investment into R&D and innovation, development of new products and finding new customers. Moreover, firms can be engaged in more than one production network. Competences acquired in one chain may be adapted in other chains (Giuliani, Pietrobelli,

[13] See also Theorelli (1986), who discussed five distinct sources of power of network participants – economic base, technology, expertise, trust and legitimacy.

Rabellotti 2005). Automotive suppliers typically supply firms in other industries such as machinery, aerospace or electronic industry and some of these chains may provide more favourable conditions for functional upgrading. Isaksen and Kalsaas (2009, p. 583) argue that *"…different parts of a company or different activities in a company may be part of different types of global network and be dominated by different types of work organization"*. They document this finding on the case of Norwegian automotive supplier Hydro Aluminium Structures' Raufoss plant – development and industrialization of new products is characterised by elements of network relations and learning form of organization, while serial production exhibits quasi-hierarchical (captive) governance and lean forms of organization.

Third, since 1990s there has been a fundamental shift in design and R&D activities from assemblers to 0.5- and 1st-tier suppliers, stimulated by the introduction of lean production, increasing complexity of automobiles (broad variety of model ranges and equipment specifications), shift towards the supply of modules rather than thousands of individual components and the need for flexibility (just-in-time delivering of modules, coping with fluctuating demand). The 0.5- and 1st-tier suppliers followed the geographical expansion of major assemblers in lower-cost countries on the periphery of the core areas of the automotive industry and set up their facilities in the vicinity of main assembly plants (Humphrey, Memedovic 2003). These organizational changes create favourable conditions for functional upgrading of the suppliers in the highest tiers of the production networks.

Fourth, there are significant differences in chain governance between American, Japanese and European firms. American lead firms tend to oscillate between market and relational linkages to the 1st-tier suppliers. On one hand, acceleration of outsourcing of design and R&D functions from lead firms to 1st-tier suppliers in the 1990s stimulated development of relational linkages based on tight co-operation and exchange of tacit knowledge (Sturgeon, Biesebroeck, Gereffi 2008). On the other hand, they have also tended to maintain market linkages and even break emerging relational ties in order to engage in predatory purchasing practices (Helper 1991). Japanese firms maintained to some extent paternalistic captive linkages, but exhibit more relational and long-term linkages to their suppliers. However, Japanese lead firms do not co-operate so much with their suppliers on the field of co-design (Sturgeon, Biesebroeck, Gereffi 2008). European firms combine the features of both American and Japanese lead firms.

Fifth, prospects of functional upgrading may significantly differ among various industries and various types of value chains. Several authors such as Giuliani, Pietrobelli and Rabellotti (2005), Humphrey and Schmitz (2004), Bazan and Navas-Alemán (2001) or Schmitz and Knorringa (2000) documented limited possibilities of functional upgrading in the case of buyer-driven value chains of traditional labour-intensive industries such as garments and footwear. Lead firms in these cases branded manufacturers, retailers and marketers – Gereffi 1999, discourage their suppliers from functional upgrading in order not to share their core competence with them. *"The source of power in a GPN is increasingly found outside the actual production, particularly in branding, product development and in the organizing of logistics and production networks"* (Isaksen, Kalsaas 2009, p. 573). The core competences of lead firms in buyer-driven value chains are often design, branding and marketing. Functional upgrading of suppliers developing such high value-added activities thus may expose lead firms to intensified competitive pressure. In producer-driven value chains including the automotive industry there is probably more space for functional upgrading of lower-tiered suppliers, because design and development of thousands of parts and components corresponds with the outsourcing strategy of assemblers and 1st-tier suppliers and their specialisation on the core activities.

Functional upgrading in (semi)peripheral countries is also influenced by changing sourcing and R&D internationalisation strategies of transnational corporations and by the

position of particular subsidiaries in the hierarchical structure of TNCs. The theory of internationalisation predicts that R&D expenditures by subsidiaries do not result in genuine innovation but only in adaptation of techniques at best (Gammeltoft 2005; Dicken 2007; Annique Un, Cuervo-Cazurra 2008; Sachwald 2008). The subsidiaries exist primarily as extensions of the parent firm and their business is to safeguard the market of the TNC in the host nation. The role of the subsidiary is supportive to the R&D function of the parent and it cannot be an innovator. Consequently, there is relatively little R&D done in the subsidiaries (Rugman 1981, pp. 135-137). The reason lies in a better access to and transfers of knowledge and technologies from the mother TNC and other subsidiaries and centres of excellence which encourage the subsidiary of a foreign TNC to invest less in R&D relative to a domestic firm (Annique Un, Cuervo-Cazurra 2008).

However, such a centralised conception of R&D is no longer sufficient; several researchers have showed that the competitiveness of firms is becoming increasingly dependent on their ability to establish a presence at an increasing number of locations to access new knowledge and capabilities (Kuemmerle 1997, p. 61). According to this view, the main motive for FDI in R&D might therefore be a firm's need to augment its knowledge base by tapping into advantageous locations. As a consequence, in an increasing number of cases, firms will invest in R&D abroad not so much as to exploit their existing competitive advantages, but to gain new advantages or complementary assets which will help sustain their global competitive competencies. In sum, an emerging view emphasizes that FDI in R&D is not only 'pushed' by the firm-specific advantages of the investor, but may also be 'pulled' towards centres of innovation located in recipient countries as a means for the investor to acquire and develop new capabilities (Shan, Song 1997, p. 269; Gassler, Nones 2008 confirmed this trend analysing TNCs R&D activities in Austria).

According to the above mentioned conceptions of R&D internationalization, Zedtwitz and Gassman (2002) distinguish between two principal motives of TNCs to internationalise their R&D – the first access to local science/technology and the second access to local markets and customers (see also Le Bas, Sierra 2002 for similar dichotomous approach). They also emphasize the differences in the localisation of research and development, which may not be co-located. Internationalisation of research is driven by the necessity to acquire new technologies, regional know-how and skilled labour force (therefore by the relative lack of scientific personnel at home). Internationalisation of development is fuelled by the firm's need to serve foreign markets, adapt technologies and develop new products for the particular markets. Development is generally more spatially dispersed than research (especially basic research), which tends to be concentrated in TNCs home regions – usually metropolitan areas in the USA, EU and Japan (see also Perrino, Tipping 1989). Based on the recognition of these two fundamental location forces and different location rationale between research and development, Zedtwitz and Gassman (2002) distinguish four archetypical forms of international R&D organization – national treasure (domestic research and development), technology-driven R&D (dispersed research and domestic development), market-driven R&D (domestic research and dispersed development) and finally global R&D (dispersed research and development).

Market-driven R&D internationalisation is the most proper strategy for the majority of automotive firms, because it fits together with the necessity to develop or adapt different models for particular markets. Automotive research is thus highly concentrated in TNCs home regions outside CE (core areas of the automobile production – USA, Japan and EU, see Bordenave, Lung 1996), while development exhibits more dispersed spatial structure. This premise corresponds with empirical findings of Pavlínek (2004), who described three different R&D internationalisation strategies of automotive firms in Czechia – global, multi-local and supplier-oriented strategy.

The global strategy is characterised by the concentration of R&D in TNCs home region, while researchers and engineers of the subsidiary are transferred to specialised R&D centres outside CE. This strategy, corresponding with the model "national treasure", is typical for companies producing single or only a few products – e.g. Barum Continental (tires) or Heyes Lemmerz (wheels). Multi-local strategy is typical for the conglomerate type of TNCs in which the production of various components is under the same financial control. In these cases TNCs tend to leave R&D centres in subsidiaries along the production facilities, because the owners often have no expertise in the particular products (e.g. PAL Praha owned by Canadian TNC Magna). In other cases the subsidiaries may develop products or technologies for all other subsidiaries of the TNC.

The supplier-oriented strategy is the most common in CE. *"Routine R&D is typically decentralized to CE, while basic research and higher R&D functions remain concentrated in specialized R&D centres usually located in home countries of foreign TNCs. The investors take advantage of highly educated inexpensive engineers and designers whose skills are compatible with their Western counterparts"* (Pavlínek, Domanski, Guzik 2009, p. 51). Expansion of Škoda's R&D centre in Mladá Boleslav represents an example of this strategy – higher research and engineering functions oriented on the platform development have been relocated to Wolfbsurg and Škoda Auto has specialised on functions related to VW Group platform adaption to use Czech-sourced components and also some routine development and design operation such as CAD. Supplier-oriented strategy thus combines the features of market-driven R&D internationalisation (concentrated research and dispersed development) and technology-driven R&D internationalisation (in order to exploit cheap and skilled researchers and engineers). Pavlínek (2004) argues that relocation of the main automotive R&D centres from the WE core regions is highly unlikely and that spatial restructuring of European automotive industry reinforced the concentration of strategic activities in the core (mostly German) regions.

One of the most important determinants enabling and driving functional upgrading in the (semi)peripheral countries is the presence of a focal firm in the particular country. Focal firms can be defined as large TNCs which are able to organize GPNs through their market and corporate power (Coe et. al. 2004). In the European automotive industry the role of focal firms is associated with the major assemblers, whose HQs are located outside CE - in core regions of USA, Western Europe, Japan and Korea. However, Pavlínek and Janák (2007) distinguish between tier-one (VW, BMW, Toyota etc.) and tier-two focal firms (Škoda – the only focal firm in CE, Seat). Tier-two focal firms are subordinated to the corporate power of tier-one focal firms. They exhibit many features of focal firms (coordinating of supplier network, end-user marketing, own R&D – see Pavlínek, Janák 2007), but the value capture and value enhancement potential (Henderson 2002; Coe et. al. 2004) compared to tier-one focal firms is limited. However, relatively high level of autonomy together with an increasing complexity and diversification of product portfolio (in order to reap economies of scope) of tier-two focal firms stimulates the development of larger R&D centres and other strategic high-value-added activities (design, marketing, logistics). Moreover, tier-two focal firms are powerful enough to attract the FTSs, which set up their production facilities and R&D centres close to their HQs. Competences of tier-one focal firms in product design, development of less sophisticated and lower value-added modules and components (to lesser extent also high value-added modules and component systems such as engines, and transmissions) and in coordination of own supplier network creates favourable conditions for the outsourcing of certain R&D activities to FTSs.

Specific models of R&D internationalisation thus result from trade off between centripetal forces favouring the geographic concentration of R&D in core regions and centrifugal forces stimulating internationalisation and geographic dispersion of R&D (Table

6). One of the most important centripetal forces limiting the prospects of functional upgrading in the automotive industry of (semi)peripheral countries are proximity constraints stemming from technological and organizational requirements of modular production (Bordenave, Lung 1996; Lung 2004).

Table 6 Factors influencing internationalisation of R&D

Factors enforcing R&D concentration	Factors enforcing R&D dispersion
economies of scale, critical mass of R&D	mergers and aquisitions
control of the core technologies, IP protection	access to unique regional know-how, local pools of skilled labor
agglomeration economies, lower transaction and communication costs	proximity to the market provides valuable feedback for marketing and product development
production of a single product that does not require much adaptation for foreign markets	broader portfolio of products requiring adaptation for foreign markets
regional embeddedness, long term relationships with suppliers, universities, research centres and other institutions	lack of scientific personnel and resources at home region
large domestic market – principal for the firm	small domestic markets
strong dominant design position of the firm	necessity of aquiring new resources to maintain technological dominance
institutional framework stimulating the process of strategic coupling	investment incentives, regulatory framework
geographical constraints – often requires proximity to decision making, design, production, sales, purchasing etc.	ability to generate entirely new technologies and products from foreign locations
cultural features (e.g. Japan firms)	monitoring scientific and technological development in foreign countries

Source: Coe, Dicken, Hess 2004; Dunning 2009; Henderson et. al. 2002; Patel, Vega 1999; Pavlínek 2004; Zedtwitz , Gassman 2002; Carrincazeaux, Lung, Rallet 2001

Assemblers introduced the principles of modular production and platform strategies in order to cope with increasing variety of models and their specifications (body, interior, equipment), reap scale and scope economies resulting from the specialisation on core activity, lower transaction costs (assemblers deal only with a limited number of FTSs), improve the quality and reliability of components, reduce design delays, costs and also risks associated with heavy R&D investment (Frigant, Layan 2009).

Introduction of modular production is connected with increasing intensity of interactions between assemblers and FTSs, which cooperate with assemblers on design and development of modules. These knowledge transfers requiring frequent face-to-face contacts together with accelerated introduction of technological innovations, broadening product portfolio and shortening the model renewal rhytm influenced the prospects of functional upgrading in two different ways (Lung 2004). On the one hand, these technological and organizational changes enhanced attractiveness of core regions, which also provide skilled labour force, proximity to the key markets, high-quality universities and public R&D institutions. On the other hand, platform renewal rhytms create an opportunity for (semi)peripheral regions to attract investment into establishment of new plants oriented on the

production of new models. For example, Skoda Fabia and Octavia (produced in Czechia) became the first models in the whole VW Group built on the new common platform (Layan 2001).

Moreover, because of rapidly growing competition, demand in (semi)peripheral regions can no longer be satisfied by run-out models (Lung 2004). Antras and Helpman (2004) impeached the pressumption that firms localize the production of run-out models into (semi)peripheral regions.[14] On the contrary, the production/assembly of core products will be localised in regions providing the most favourable conditions – lower production costs combined with geographical proximity of the EU market and skilled labour force in the case of CE. Thus, production of new models characterised by high level of technological complexity and broad variety of car specifications often requires the co-location of supportive R&D (both on assembler's and FTS's side), oriented either on the adjustment of models for a host market or on resolving the technical problems (Frigant, Layan 2009; Pavlínek 2004).

Carrincazeaux, Lung and Rallet (2001) in their comprehensive analysis of proximity constraints related to industrial R&D location recognized two important factors enforcing R&D concentration in core regions – the nature of critical interfaces and complexity of knowledge base. Critical interfaces can be defined as linkages crucial for co-ordination of a particular R&D activity that create the most significant knowledge spillovers[15].

The nature of critical interfaces explains firm's particular location choices, but the real catalyst of these proximity needs is knowledge complexity in the start up of a critical interface (Carrincazeaux, Lung and Rallet 2001, p. 779). It is possible to distinguish between technological complexity (knowledge base renewal frequency and the degree of novelty of produced knowledge, which is low in the case of standardized production and routinized R&D activities) and combinatory complexity (how difficult is co-ordination of different knowledge bases, which increases with increasing heterogeneity of knowledge base) – e.g. automotive assemblers and FTSs combine modules and components from various branches - machinery, electronic, plastic industry etc. Automotive industry can thus be characterised by high values of both technological and combinatory complexity, "private" external interface, high level of geographical concentration of R&D and also by high correspondence between interfaces and R&D location in terms of co-location of assembler's and supplier's R&D in metropolitan regions. Authors also concluded that *"the geographical distribution of an industry's R&D activities is, therefore, principally affected by the spatial concentration of its production activities, all the more so when research and production interact intensively"* (Carrincazeaux, Lung, Rallet 2001, p. 788).

Lung (2004) emphasized crucial importance of internal and also public interface in the case of European automotive industry. Significant proximity constraints favouring agglomeration of design and other strategic functions such as R&D, finance, marketing, purchasing and technology-intensive production have been identified. Extraordinarily high technological complexity of automobiles and modules in terms of their compatibility, uncertainty about the success of new products and large accumulated sunk-costs related to design and development of new models require co-location of design/R&D centres and decision making in corporate HQs. Lung (2004) documented a trend of spatial concentration of assembler's product design resources. *"This clustering of carmakers' design activities has*

[14] There are some examples of this trend in the European automotive industry – for instance Serbian firm Zastava, which produces previous generation of Fiat Punto in Kragujevac.

[15] It is possible to distinguish between "internal interface" (interactions between R&D and production activities inside a single firm are critical), "external research interface" (interactions between various firms) and "public research interface" (between industrial R&D activities and academic research centres). Thus, firms for which internal interface is critical tend to co-localise their production activities, external interface stimulates clustering of firms (both in a single or in various industries) and public interface favours regions offering high density of universities and research institutions – often metropolitan areas.

happened in urban agglomerations offering a cornucopia of qualified workers (presence of young graduates, proximity of schools, interfirm mobility for engineers) plus access to diversified external resources" (Lung 2004, p. 19). The importance of private interface may be demonstrated by attractiveness of technological districts (such as Emilia Romagna or Motorsport Valley in the UK) – see Chanaron (2002).

What is even more important – high technological complexity and exclusivity of modules for particular automobiles requires geographical proximity and close collaboration between assembler and FTS and among various FTSs during design of general architecture of modules. Frigant and Layan (2009) emphasize the duality of R&D site locations. On one hand, design and development of modules (macrocomponents) and their integration into overall vehicular architecture requires complex face-to-face interaction between assembler and FTS, which are enabled by the geographical proximity. On the other hand, detailed architecture of macrocomponents, development of their internal mesocomponents and (generic) components does not need to be located in the vicinity of assemblers. Frigant (2007) described dual R&D location strategy of FTS. *"FTS find it hard not to build their development centres in those countries where carmakers have situated their design activities… Our empirical results confirm that FTS have generally built a greater number of development centres in countries where carmakers run operations. One apparently paradoxical element in this movement is the fact that certain design activities that FTS used to carry out in emerging automobile countries like Brazil or India now tend to be repatriated to central countries"* (Frigant 2007, p. 21). These trends can be explained by the shift to the modular production and platform strategies, which enable most of the local adaptations of products to be made in central design studios (Frigant 2007).

To conclude – the majority of automotive design and R&D has been still located in core European regions in order to ensure tight collaboration between R&D, production and strategic non/production functions inside each firm and between assemblers and FTS, stimulate knowledge spillovers, reap scale economies and gain access to external sources (skilled labour force, linkages to academic research institutions) – Bordenave and Lung (1996); Frigant and Layan (2009); Lung (2004). Thus, design/R&D of (meso)components and internal specifications of macrocomponents can be delocalised to (semi)peripheral regions in order to capitalize on their cheap and skilled labour force or industrial tradition. CE regions are expected to attract more routine and less sophisticated R&D (such as CAD functions) and also development oriented on the product adaption for local markets.

The opportunities for functional upgrading of local suppliers are also heavily influenced by local institutional contexts and the configuration of regional assets such as skilled labour force, quality technical universities and availability of local technology know-how (see for instance Coe et. al. 2004; Henderson 2002). In terms of policy implications it can be noted that the national system of innovation should therefore strengthen the technological advantages of local firms (Le Bas, Sierra 2002).

5. Conclusions

This dissertation thesis includes four papers published in peer-reviewed journals; each of them was focused on answering one of the four research questions.

In the **first research question** the author asked which manufacturing industries in Czechia are potentially threatened by relocation of production activities to the Eastern European and Asian lower-cost countries the most? This question was answered in the paper:

ŽENKA, J. (2009): Delocalization of the Czech Manufacturing Industry (a component analysis). Politická ekonomie, 57, No. 1, p. 77-91. [in Czech]

The probability of international firm's relocation was evaluated statistically through the quantification of "keep factors", which strengthen manufacturing location inertia. Firms with low values of indicators measuring the intensity of keep factors (capital intensity, labour productivity, R&D intensity) were considered footloose and thus highly susceptible to relocation of production/assembly activities. Despite the complexity and multifactorial determination of manufacturing (re)location processes, location inertia is in practice influenced mostly by the combination of two fundamental mechanisms. The first mechanism can be explained using the concept of sunk costs, which present a direct barrier and make the potential relocation of production activities more expensive. The second mechanism is regional embeddedness, which provides a vital prerequisite for increasing specialization, innovation output and competitiveness. Moreover, the process of embedding into social networks at local/regional level increases external sunk-costs in the form of transaction costs. Other keep factors influence location inertia through increasing sunk costs or reinforcing firm relations with regional subjects and institutions. Main empirical conclusions may be summarized in the following way:

1) No significant relation between the technological intensity and location stability of production activities on the manufacturing branch level was found. The majority of jobs potentially threatened by international relocation was identified in the case of medium-high-tech and to lesser degree also high-tech industries – manufacturing of electrical equipment n.e.c., manufacturing of parts and accessories for motor vehicles, plastic products, other special purpose machinery and manufacturing of office equipment and computers.
2) More detailed analysis showed that the majority of jobs threatened by relocation are connected to the automotive value chain in supplying industries. The automotive industry was also identified as the industry exhibiting largest internal differences in location stability of firms, which were found among the firms with the highest and also the lowest ranking. Labour and marketing-intensive branches (textile and clothing industry, production of sports goods, bicycles and motorcycles, etc.) exhibited the highest share of jobs threatened by relocation, however in absolute numbers did not pose any significant challenge for the Czech labour market – with regard to their generally smaller share in total manufacturing employment.

Identification of manufacturing branches threatened by potential delocalisation was followed by detailed empirical examination of regional distribution of nomadic firms.

The **second research question** was to determine whether footloose assembly/production activities in technology-intensive manufacturing industries (high-tech and medium-high-tech – see Hatzichronoglou 1997) are rather localised in economically less developed regions with high unemployment rate and available investment incentives, therefore in regions potentially most threatened by delocalisation of manufacturing activities. This question was answered in the second paper:

ŽENKA, J., ČADIL, V. (2009): Regional distribution of technology-intensive manufacturing industries in the Czech Republic with an accent on risk of delocalization. Prague Economic Papers, 1, p. 61-77.

Main findings of the second paper can be summarised in the following points:

1) Localisation/regional distribution of nomadic firms in technology-intensive manufacturing industries in Czechia follow similar regional pattern of technology-intensive industries as a whole. Localisation of major firms in technology-intensive industries in Czechia corresponds neither to the settlement hierarchy nor to the innovation/economic performance of regions. Due to the low concentration of technology-intensive production activities in metropolitan centres and traditionally strong position of small and medium industrial centres (except for the above mentioned regions providing favourable conditions for cost-oriented investment) the majority of nomadic firms are concentrated outside both metropolitan and structurally affected/peripheral regions.
2) The hypothesis on the concentration of internationally mobile firms in economically lagging districts with high unemployment and availability of investment incentives was thus not confirmed. Footloose firms are mostly concentrated in Prague and in various districts of Plzeňský and Karlovarský regions. The excessive concentration of those firms in proximity of German borders indicates the intensive cross-border cooperation with German parental companies, which have been subcontracting their production and assembly activities since the beginning of 1990s.
3) Regional differences in the probability of international relocation are the consequence of inherited specialisation of industrial production and qualification of labour force from the socialist era. Pre-1989 localisation pattern of large firms in technology-intensive (automotive industry, machinery, electronics) and capital-intensive industries (basic chemicals in Středočeský and Ústecký region) heavily influenced regional variations of capital intensity, labour productivity and distribution of R&D centres.
4) Based on the statistical evaluation of above mentioned indicators of the probability of international relocation, it can be concluded that footloose firms are geographically dispersed across the Czechia and can be found in all types of Czech regions. Structurally affected, economically weak regions and regions with high unemployment did not exhibit less favourable structure of technologically-intensive branches compared to the metropolitan regions – the share of footloose firms in total employment in technology-intensive manufacturing industries is roughly comparable in all types of regions.

Above mentioned results highlighted the importance of the automotive value chain for the prospects of regional development in Czechia and despite the regional dispersion of nomadic firms also high potential vulnerability of many micro-regions, which are over-dependent on the automotive and supplier industries.

The **third research question**, to what extent has the economic crisis of the Czech/EU automotive industry in 2008-2009 affected the development of regional disparities in unemployment in Czechia, was answered in the following paper:
PAVLÍNEK, P., ŽENKA, J. (2010): The 2008-2009 automotive industry crisis and regional unemployment in Central Europe. Cambridge Journal of Regions, Economy and Society, 3, No. 3, pp. 349-365.

We also asked whether the regions that are concentrating firms on the lowest tiers of the automotive value chain were during the recent economic crisis affected by collective dismissals more than regions positioned in higher tiers of value chains. Therefore, we tried to test a hypothesis assuming that lead firms in GPNs will be able to use their corporate power to transfer the necessity of collective dismissals resulting from falling demand to their suppliers – in many cases domestically-owned firms. The mode of collective dismissals was also the case of our concern – it was expected that in lower tiers of value chains will be more dismissals due to bankruptcies and plant closures. Based on the empirical analysis of 2008-2009 trends in unemployment growth and collective layoffs on the firm level we found that:

1) Neither the rapid 1998-2007 growth of the automotive industry nor the 2008-2009 crisis significantly altered the long-term regional pattern of unemployment in Czechia. Automotive industry was, however, most responsible out of all manufacturing industries for increases of regional unemployment. Traditional centres of the automotive industry and also peripheral microregions along the German and Austrian borders were among the most affected regions by the 2008-2009 crisis in the automotive industry.
2) No significant relation between a firm's position in the value chain and its propensity to dismiss employees was found. Lead firms and large suppliers were affected similarly to third-tier suppliers on the bottom of the value chains. Nevertheless, in the latter group of firms, bankruptcies/plant closures were more often – especially in labour intensive production or assembly activities such as manufacturing of wire harnesses or seat coats.

Due to significant potential impacts of the automotive industry on the probability of relocation and real impacts on the unemployment growth in 2008-2009, **the fourth research question** is thus whether and to what extent has been the Czech automotive industry moving to the semi-peripheral position in the European automotive value chain since 1998. This research question was answered by the fourth paper, which is regarded as the core of the whole dissertation thesis, measuring directly the intensity of industrial upgrading on the case of FDI-driven transformation of the Czech automotive industry.

PAVLÍNEK, P., ŽENKA, J. (2011): Upgrading in the automotive industry: firm-level evidence from Central Europe. Journal of Economic Geography, 11, p. 559-586.

Furthermore, a detailed analysis oriented at the functional upgrading was based on a working paper presented at the XXII. Meeting of the Czech Geographical Society in Ostrava 2010 Passages from both of these materials were used in section 4.1 on the pages 28-36.

PAVLÍNEK, P., ŽENKA, J., ŽÍŽALOVÁ, P. (2010): Functional upgrading through research and development in the Czech automotive industry. Working paper presented at the XXII. Meeting of the Czech Geographical Society in Ostrava 2010.

Main conclusions based on above mentioned text can be summarized as follows:

1) The most important factor affecting the value of upgrading indicators was the massive inflow of FDI and rapid expansion of foreign-owned companies in Czechia through investment into mostly greenfield production and assembly plants between 1998 and 2006. As a result, the total automotive employment and production was growing faster than R&D employment and R&D expenditure, the technological intensity of the automotive industry (R&D expenditure in value added) thus in the analyzed period decreased.
2) Despite the extensive character of growth between 1998 and 2006, significant processes of industrial upgrading were taking place in the Czech automotive industry. Both domestic and foreign-owned firms exhibited intensive product, process and to lesser degree also functional upgrading. Process upgrading was identified as the most widespread and intensive type, because continuous innovations leading to increases in productivity are vital precondition for suppliers to maintain their competitivess in highly competitive and challenging automotive industry.
   As Womack et. al. (1990) argued, lead firms on the top of the automotive production networks (major assemblers) tend to stimulate the introduction of process innovations of their suppliers by introduction of new production technologies, organization models and management practices, strict quality standards and also cost reduction requirements, which pressure the suppliers to increase labour productivity and quality of their production and logistics. Increasing values of labour productivity, capital and technological intensity of almost all automotive firms between 1998 and 2006 empirically verified these premises for the case of the Czech automotive value chain. These results were also confirmed by 90 interviews conducted in the period 2009-2011 among both domestic and foreign-owned assemblers and suppliers in Czechia – managers argued that quality, technological intensity and generally competitiveness of domestic-owned suppliers is comparable to the foreign suppliers and that they usually do not concern themselves with the fact whether their suppliers are domestic or foreign-owned.
3) Industrial upgrading of the Czech-based automotive firms was highly selective and uneven – process upgrading less, product upgrading more and functional upgrading was identified only in 20% of analyzed firms and – to a certain degree - it was limited to the group of 10 largest assemblers and first-tier suppliers. These results thus empirically confirmed the findings of Humphrey and Schmitz (2004), who argued that captive-value chains (typical for the automotive industry) provide favourable conditions for product and especially process upgrading, but may hinder functional upgrading as lead firms try to prevent their suppliers from tapping into the sphere of their competitive advantage.
4) In spite of its highly selective nature, functional upgrading was identified as a vital process through which Czech regions may move to the upper parts of value chains and gradually converge into the core of the EU automotive industry. There are neither significant differences in the product portfolio nor in the (wage adjusted) labour productivity, quality and technology-intensity of production between Czechia and Western European countries (WE). What distinguishes Czechia from the EU automotive core is significantly lower concentration of R&D centres. Statistical analysis revealed, however, that in term of R&D intensity Czechia to a certain degree broke out of the CE peripheral context and converged to more economically developed WE countries in the semi-peripheral position of the EU automotive value chain – Spain, Belgium and Austria.

> Nevertheless, the Czech automotive R&D is mostly oriented on less sophisticated functions such as experimental development/modification of products, technical support of production, modifications of products for local and CE markets, which all points towards the persistence of strong peripheral tendencies in the Czech automotive industry despite the relatively high knowledge content of the automotive R&D in Czechia. Moreover, almost all large (in CE context) R&D centres are now being controlled by foreign capital, importing the most advanced technologies and fundamental innovations from the TNCs located outside of Czechia.

Based on above mentioned findings, we can draw two final conclusions of this dissertation, which are, to some measure, beyond the scope of empirically oriented research questions.

Firstly, our research confirmed the conclusions of Bruinsma, Gorter and Nijkamp (1998) that purely nomadic firms are very rare phenomenon. Although we found many firms with nomadic[16] features, the Czech automotive industry exhibited surprisingly high location inertia and stability at times of 2008-2009 economic crisis. Greenfield automotive production and assembly plants are in many cases tied to their principal customers, as just-in-time regime of supplying requires geographical proximity to the assemblers. Lung (2004), Frigant and Layan (2009) contrasted co-location of the assemblers and their major first-tier suppliers (focused on the production of macrocomponents) and spatial dispersion of the third-tier suppliers (focused on the production of microcomponents).

In the case of the Czech automotive industry, our findings confirmed the conclusion of Pavlínek and Janák (2007) that Czech-based third-tier suppliers exhibited strong tendency to localize their plants in the vicinity of large assemblers (Škoda Auto), integrating themselves into large clusters in order to capitalize on agglomeration economies and the availability of technically skilled labour force. Therefore, even subsidiaries in lower parts of automotive value chains exhibited relatively high level of regional embeddedness. This trend can be documented on the case of the TPCA assembly plant in Ovčáry near city of Kolín, which sources 90% of its supplies from firms located up to 100 km from Ovčáry.[17] However, TPCA taps mainly in its own suppliers, who followed TPCA and established their production facilities in the vicinity of their principal customer – with significant entry barriers for other Czech-based suppliers. Spatial clustering of third-tier suppliers is, however, also heavily influenced by historical evolution of the Czech automotive industry.

Secondly, despite initial expectations, production labour-intensity was a more important factor influencing the intensity of collective dismissals (in the form of international relocations and plant closures) than the position of a subsidiary in the hierarchical structure of TNCs and generally in GPNs. During 2008-2009 automotive industry crisis, firms at the lowest parts of GPNs exhibited comparable intensity of labour shedding as the lead firms and first-tier suppliers. While the majority of Czech-based automotive firms reported only labour shedding due to in situ internal restructuring, bankruptcies and plant closures took place in the group of subsidiaries specialized in labour-intensive production such as manufacturing of wire harnesses or seat coats. Automotive value chain is very heterogeneous in terms of labour-intensity of production and these high internal differences seem to be more important for the long-term competitiveness and prospects of regional development potential than the position of firms in GPNs.

[16] Cost-oriented, disembedded, low capital intensity, low investment into fixed assets, export-oriented, absence of strategic functions, low skill requirements

[17] Interview with Radek Kňava, corporate affairs department, 8.3.2011

Therefore, technology-intensity and organizational models of the production process together with the complexity of supply chain management (including regime of deliveries and logistics) seem to be the most important factors influencing the probability of international relocations, plant closures and generally larger-scale employee dismissals. Nevertheless, surprisingly strong location inertia and resistance of the Czech automotive industry at times of 2008-2009 economic crisis showed that it is not sufficient to study only firm's propensity to relocate or terminate production activities. It is necessary to study those issues in a broader context of regional development with an emphasis on value creation, value capture and value enhancement processes, which stem from successful coupling of strategic needs of TNCs and regional factor endowments. The GPN perspective, which emphasizes the importance of extra-regional factors of regional development (strategic needs of the TNCs), provides us with necessary and very useful conceptual framework for studying the relationships between industrial upgrading and regional competitiveness (Henderson et. al. 2002; Coe et. al. 2004; Yeung 2009 a,b).

6. Literature

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7. Published papers