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Linkages and spillovers in global production networks: firm-level analysis of the Czech automotive industry

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Abstract

The aim of this article is to analyze the linkages between and spillovers from foreign-owned (foreign) to domestic-owned (domestic) firms in the Czech automotive industry. Theoretically and conceptually, our research draws on two strands of literature: spillovers, linkages and effects of foreign direct investment on domestic firms and regional economic development; and literature on global production networks, global value chains and industrial upgrading. Empirical analysis is based upon unique data collected by the authors through a questionnaire completed by 317 foreign and domestic firms in 2009 and on-site interviews with 100 firms conducted between 2009 and 2011. Data analysis has identified a low share of domestic suppliers in the total supplies of Czech-based foreign firms and diverse spillover effects from foreign to domestic firms. Domestic firms vary in their capabilities and absorptive capacity which, along with the particular nature of the contemporary automotive value chain, significantly influence their ability and potential to benefit from linkages and spillovers.

Keywords: Linkages, spillovers, automotive industry, domestic and foreign firms, Czechia

JEL classifications: L62, D24

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1. Introduction

In an increasingly globalized economy, and especially in less developed and middle-income economies, the role of transnational corporations (TNCs) is considered to be crucial for economic development (Meyer, 2004; Jindra et al., 2009). Value creation is a fundamental precondition for successful economic development (Henderson et al., 2002; Coe et al., 2004) and TNCs can create or enhance opportunities for value creation by their decisions to invest in particular countries, regions and localities. Through the geographic diffusion of broadly defined technology, which in addition to production methods and technologies includes production organization and management (Görg and Greenaway, 2004), foreign direct investment (FDI) has direct and indirect effects on host economies. Direct effects include employment effects, trade effects, effects on capital formation and tax revenues. Indirectly, FDI may influence the industrial environment of host economies and the behavior and performance of host country firms in the form of spillovers from foreign-owned (henceforth foreign) firms through

acquisition of skills, through imitation, competition and exports (Blomström and Kokko, 2001; Görg and Greenaway, 2004; Dunning and Lundan, 2008). In other words, the productivity and/or efficiency of host country firms may increase following the entry of foreign firms as foreign investors are unable to fully internalize their firm specific advantages, such as superior process and product technology and marketing skills, which may spill over to local firms (Blomström et al., 2000; Blomström and Kokko, 2001; Dunning and Lundan, 2008).

The aim of this article is to analyze linkages between foreign and domestic-owned (henceforth domestic) firms and spillovers from foreign to domestic firms in the Czech automotive industry. The contemporary automotive industry is typified by the high degree of vertical disintegration and, therefore, by strong backward linkages between lead firms (assemblers) and hundreds of their component suppliers organized in hierarchically structured production networks (Humphrey and Memedovic, 2003). The automotive industry thus represents an excellent economic sector to study spillovers from foreign to domestic firms. With the 2012 production of 1.2 million vehicles, the Czech automotive industry provides a relevant example of the automotive industry periphery that has been integrated into the European and global automotive production networks through large inflows of FDI since the early 1990s (Pavlínek, 2002a, 2002c, 2003). However, despite the importance of the automotive industry for the Czech economy and the dominant role of FDI in the sector (Pavlínek, 2008, 2012a, 2012b; Pavlínek and Ženka, 2010, 2011), FDI's effects on domestic firms in the Czech automotive industry have not been systematically studied. In this article, we employ the qualitative research methodology to focus on backward linkages between TNCs' foreign subsidiaries and domestic suppliers through buyer–supplier relationships, because they are considered to be the most important channel through which spillovers develop (Javorcik, 2004; Ivarsson and Alvstam, 2005; Blalock and Gertler, 2008). We have collected unique data about the effects of foreign investors on domestic automotive firms through a questionnaire completed by 317 foreign and domestic firms in 2009 and on-site interviews with 100 automotive firms between 2009 and 2011. Our main goal is to evaluate the extent to which linkages and spillovers from foreign to domestic firms have developed in the Czech automotive industry after its liberalization in the early 1990s and through which mechanisms they occur because the study of mechanisms of FDI spillovers has been neglected (Meyer, 2004; Spencer, 2008; Contreras et al., 2012; Hallin and Lind, 2012). Specifically, we focus on three questions: First, how strong are the linkages between foreign and domestic firms and what kind of spillovers can be identified in the Czech automotive industry? Second, what are the effects of these linkages and spillovers on technological, organizational and strategic competences of domestic suppliers? Third, why are some domestic suppliers able to benefit from linkages with foreign firms to enhance their competitiveness and improve their position in the automotive value chain while others are unable to do so?

Theoretically and conceptually, our research draws on two strands of literature. First is vast literature on spillovers, linkages and effects of FDI on domestic firms and regional development (e.g. Firn, 1975; Dicken, 1976; Britton, 1980; Hayter, 1982; Phelps, 1993; Amin et al., 1994; Aitken and Harrison, 1999; Blomström and Kokko, 2001; Hansen et al., 2009; Jindra et al., 2009). Second is literature on global production networks (GPNs,) global value chains (GVCs) and industrial upgrading (e.g. Kaplinsky, 2000; Henderson et al., 2002; Humphrey and Schmitz, 2002; Gereffi et al., 2005).

We argue that spillover effects from FDI at the firm level vary significantly across the Czech automotive industry and are strongly affected by differences in the capabilities and absorptive capacity of domestic firms and by the changing organization of the automotive industry. Our analysis suggests that domestic firms were affected by horizontal and vertical spillovers in the 1990s and 2000s. Indirect horizontal and vertical spillovers were more important than direct vertical spillovers in the form of direct technology and knowledge transfer from foreign to domestic firms despite the integration of domestic firms into automotive GPNs through the development of supplier linkages with foreign firms. The importance of direct spillovers varies with the capabilities of domestic firms to exploit them and is related to the position of firms in the automotive value chain and the supplier hierarchy.

The article is organized as follows. We begin with a discussion of the relationship among FDI, linkages and spillovers in which we emphasize the importance of linkages between foreign and domestic firms for the potential development of spillovers. Next, we demonstrate how changes in the organization of the contemporary automotive industry undermined the position of domestic firms in the automotive GPNs and with it the potential for spillovers from foreign to domestic firms. In the fourth section, we briefly analyze the general effects of FDI in the Czech automotive industry and we argue that FDI resulted in productivity spillovers but not necessarily in technology spillovers. In the fifth section, we present an empirical analysis of linkages between foreign and domestic firms based on our unique quantitative firm-level data. In the sixth section, we examine spillovers from foreign to domestic firms. We summarize the main findings of the article in the conclusion.

2. FDI, linkages and spillovers

After decades of research following the work of Caves (1974), there is no academic consensus about the benefits and drawbacks of FDI for host economies generally and for productivity of domestic firms in the form of spillovers specifically. This lack of consensus has been explained, for example, by the different ways in which FDI spillovers are measured. Differences in research design, methodology and data can influence research results (Barrios et al., 2011). While analyses using cross-sectional data tend to find statistically significant spillovers on productivity of domestic firms, panel data econometric techniques tend to find statistically negative or insignificant spillovers (Görg and Strobl, 2001; Javorcik, 2004; Meyer, 2004). The lack of consensus on FDI spillovers also reflects the fact that FDI effects on host economies depend on a large number of different factors, such as FDI characteristics, the size of host country firms, the nature of vertical linkages between foreign and domestic firms, worker mobility, the technological gap between foreign and host country firms and the absorptive capacity of domestic firms (Blomström and Kokko, 2001; Görg and Greenaway, 2004; Crespo and Fontoura, 2007; Smeets, 2008; Havranek and Irsova, 2011). Spillovers also differ within individual countries depending on the industry, the nature of operations, the mode of entry of foreign investors, the length of time since the original investment, the domestic or export market orientation of foreign firms, and other factors (e.g. Amin et al., 1994; UNCTAD, 2001; Carrillo et al., 2004; Scott-Kennel, 2007; Dicken, 2011). Furthermore, Meyer and Sinani (2009) have argued that spillovers vary according to the level of economic development of host countries with

very rich and very poor countries benefiting from inward FDI, while middle income economies being negatively affected by FDI. In contrast, according to Blomström and Kokko (2001), the poorest developing countries do not benefit from FDI spillovers but middle-income economies do. There are also important differences within individual countries with more developed regions benefitting economically more from foreign subsidiaries than less developed regions (Dimitratos et al., 2009). Potential benefits of FDI for host economies thus strongly depend on the context of the individual countries and are, therefore, highly spatially variegated. Despite this lack of academic consensus on the effects of FDI in host economies, policy makers tend to assume generally positive FDI effects on host economies and host country firms, especially in terms of FDI's potential for technology and knowledge transfer (Harding and Javorcik, 2011; Hallin and Lind, 2012). This belief has translated into economic policies that are supportive of FDI in the majority of countries and in vast public expenditures to attract FDI in both more and less developed countries (Meyer, 2004; Harding and Javorcik, 2011; UNCTAD, 2012).

In this article, we differentiate between productivity and technology spillovers. Productivity spillovers are defined as the effect of the presence of foreign firms on productivity in domestic firms (Görg and Strobl, 2001) in the form of increased availability of information regarding more efficient production processes of foreign firms in a host economy. The presence of foreign firms also increases the pressure on domestic suppliers to become more efficient through productivity improvements in the form of better machinery and organization of production. Foreign firms typically have specific requirements on domestic suppliers in terms of the quality of supplied parts and components, such as technology audits and quality certificates, before they can start supplying foreign firms. Meeting these requirements increases the productivity and competitiveness of domestic firms, which can be achieved without the direct or indirect transfer of technological knowledge and know-how from foreign firms. Domestic firms thus become more efficient by imitating the process technologies of foreign firms while, at the same time, lacking innovation capabilities to further exploit, advance or develop these technologies. As such, productivity spillovers are especially related to process upgrading in domestic firms. Technology spillovers refer to the diffusion of technology and know-how from foreign to domestic firms (Hatani, 2009) in such a way that will make them not only more efficient producers but also increase their innovation capabilities through the transfer of technological know-how. For example, new specialized software will allow domestic firms not only to contribute to cost reductions and increased efficiency but will also allow them to design and produce their own tools or molds they used to buy from other firms, which will increase the value-added of their production. Thus, technology spillovers, in addition to process upgrading, may also encourage product and functional upgrading in domestic firms. By distinguishing between productivity and technology spillovers we are trying to distinguish between more efficient production on one side and increased technological capabilities on the other side that would allow domestic firms to narrow the gap between them and foreign firms. We argue that more efficient production and the use of better technologies broadly defined do not necessarily increase the technological capabilities of domestic firms. At the same time, we recognize that productivity and technology spillovers are closely interrelated.

Spillovers from foreign to host country firms have two basic forms, horizontal and vertical. Horizontal spillovers are mostly unintentional spillovers to firms in the same

industry, including competitors, while vertical spillovers are unintentional and intentional spillovers to domestic suppliers and customers (Blalock and Gertler, 2008; Hallin and Lind, 2012). Vertical spillovers to a large extent depend on the development and intensity of forward and backward linkages between TNCs' foreign subsidiaries and domestic firms through buyer–supplier relationships in the host economy (UNCTAD, 2001; Giroud and Scott-Kennel, 2009; Hansen et al., 2009). These forward and backward linkages may lead to intended and unintended spillovers of technologies, skills, various forms of knowledge and know-how from foreign to domestic firms (Blomström and Kokko, 2001; Giroud and Scott-Kennel, 2009) (Figure 1).

Linkages between foreign and domestic firms are thus an important precondition for vertical spillovers to occur (Blomström and Kokko, 1998; UNCTAD, 2001; Görg and Strobl, 2005; Scott-Kennel, 2007; Santangelo, 2009). The impact of linkages on domestic firms could be both positive and negative, depending on what Cohen and Levinthal (1989) called a firm's 'learning' or 'absorptive' capacity (see also Cohen and Levinthal, 1990; Girma, 2005). Absorptive capacity refers to the ability of firms to 'identify, assimilate and exploit knowledge from the environment' (Cohen and Levinthal, 1989, 569). It also includes the ability of firms to identify and exploit new scientific and technological knowledge generated by public research centers and universities (Cohen and Levinthal, 1989). As such, absorptive capacity depends particularly on R&D capabilities of firms (Cohen and Levinthal, 1989; Sturgeon et al., 2010) and it is enhanced by their R&D investment. Firms that conduct their own R&D are better at using and imitating external knowledge than firms without their own R&D, including better abilities to imitate externally available process or product innovations generated by other firms (Cohen and Levinthal, 1989, 1990). Domestic firms that are able to absorb foreign technology and improve their overall competitiveness can benefit from their integration into GPNs through increased production, sales and employment (Scott-Kennel, 2004; Ivarsson and Alvstam, 2005). Such firms can also gradually improve their position in GPNs and GVCs through improved capabilities and functional upgrading (Humphrey and Schmitz, 2002). Absorptive capacity is thus considered to be crucial for the ability of domestic firms to benefit from FDI (Ernst and Kim, 2002; Kohli, 2004; Meyer, 2004) and upgrade their production and products or services to meet buyers' requirements (Dunning and Lundan, 2008). Low technological and organizational capabilities of domestic firms may prevent them from absorbing foreign technology and from benefitting from the presence of foreign firms. This may result in negative consequences for domestic firms caused by FDI, such as crowding out effects, leading to the loss of competitiveness, downgrading and closure (Blomström and Kokko, 1998; De Backer and Sleuwaegen, 2003; Görg and Greenaway, 2004; Oetzel and Doh, 2009). Generally, the absorptive capacity of domestic firms as well as the number and intensity of linkages tend to increase with the overall level of development of host economies (Dunning and Lundan, 2008; Meyer and Sinani, 2009). However, large differences exist between different industries and different regions in the degree of linkages, especially in less-developed economies (UNCTAD, 2012).

The increasing integration of developing country suppliers into GPNs and GVCs, which are mostly organized by developed country lead firms, has not necessarily lead to the formation of strong linkages between foreign subsidiaries and domestic firms (e.g. Belderbos et al., 2001; Pavlínek, 2004; Giuliani et al., 2005). The experience of weak linkages between foreign and domestic firms has also been the case of peripheral regions

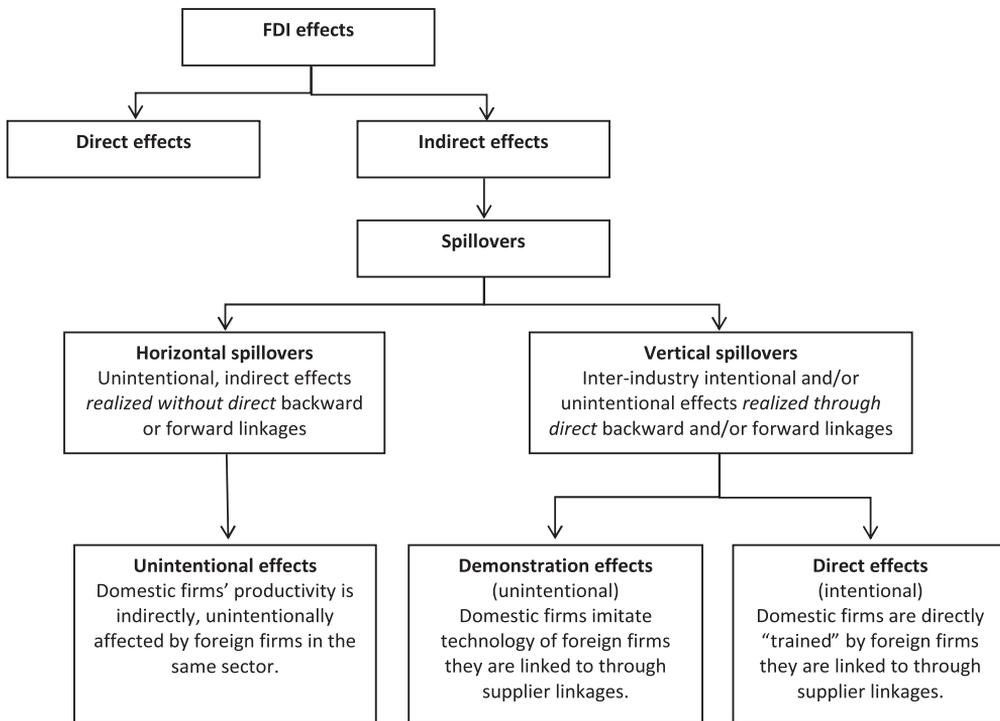


Figure 1. The classification of spillovers.

Source: The authors.

in developed countries (e.g. Schackmann-Fallis, 1989; Crone, 2002; Hewitt-Dundas et al., 2005; Tavares and Young, 2006). Especially small domestic firms face high-entry barriers to GPNs and GVCs (Hatani, 2009; Nolan and Zhang, 2002).

It has long been recognized by economic geographers and economists that (technology) spillovers are innately geographical (e.g. Jaffe et al., 1993) because the geographic proximity of economic actors increases the chances for spillovers by facilitating the flow of information, especially among firms with linkages within regional production systems (e.g. Florida, 1996). In addition to localized patterns of codified knowledge, geographic proximity facilitates face-to-face contacts and the exchange of highly localized tacit knowledge (Gertler, 2003; Howells, 1996, 2002; Storper and Venables, 2004). The exchange of information and interactions of firms within clusters may increase firms' capabilities through processes of localized learning (Maskell and Malmberg, 1999, 2007; Bathelt et al., 2004). The clustering of suppliers around assembly plants as well as the clustering of automotive R&D is typical for the contemporary automotive industry and has been well documented (e.g. Carrincazeaux et al., 2001; Frigant and Lung, 2002; Lung, 2004; Sturgeon et al., 2008). Our previous research has identified such clustering of suppliers and R&D in the Czech automotive industry (Pavlínek and Janák, 2007; Pavlínek, 2012b). Figures 2–3 suggest the importance of clustering in the Czech automotive industry around large passenger car assembly plants, in and around large cities, especially Prague, Pilsen and Brno, and along highways connecting Prague with Liberec through Mladá Boleslav (the main

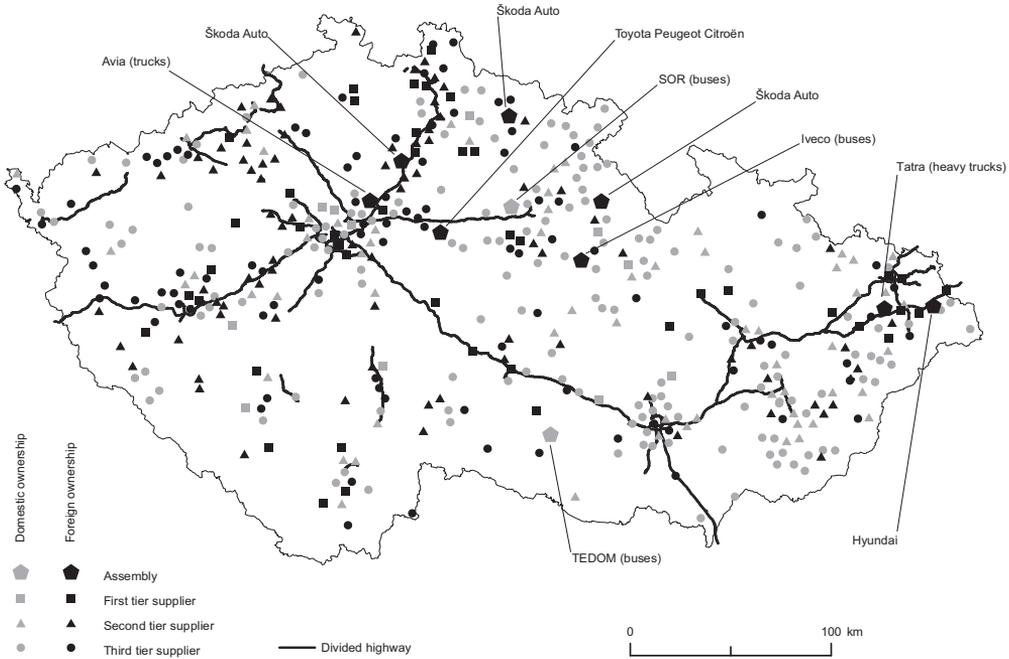


Figure 2. The 2009 spatial distribution of foreign and domestic automotive firms in Czechia based on their position in the supplier hierarchy.

Source: Authors.

Škoda Auto production complex) and with Pilsen and Germany. Both foreign and domestic firms are located in these clusters. Based on the previous research, we can thus assume that the clustering and agglomeration of automotive suppliers facilitate the development of spillovers between foreign and domestic firms in the Czech automotive industry.

3. Internationalization of the automotive supplier industry and its consequences for domestic suppliers in less developed countries

Before turning to the empirical analysis of linkages between foreign and domestic firms and spillovers in the Czech automotive industry, we will first investigate the position of domestic firms in automotive GPNs and review the general effects of FDI in the Czech automotive industry. In this section, we briefly demonstrate how the increasing globalization of the automotive industry has undermined the position of domestic suppliers in automotive GPNs. Consequently, the potential for linkages and vertical spillovers from foreign to domestic firms has been diminished.

The contemporary automotive industry represents a typical example of quasi-hierarchical (captive) value chains in which powerful lead firms organize and regulate vertical production networks of component suppliers (Humphrey and Schmitz, 2004; Gereffi et al., 2005). Large assemblers (lead firms) set the basic parameters of automotive GPNs by wielding their corporate and market power. Lead firms define the

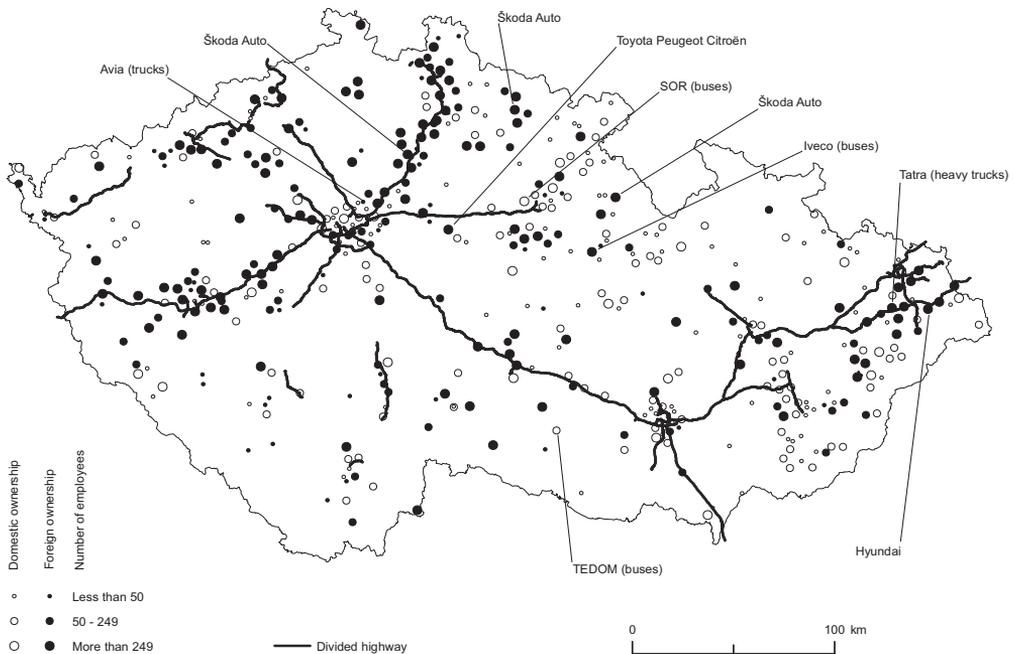


Figure 3. The 2009 spatial distribution of foreign and domestic automotive firms in Czechia based on their number of employees.

Source: Authors.

architecture of the final product and of its crucial parts, select suppliers of modules and the most important components, set the schedule of their deliveries, and develop quality control mechanisms to be employed throughout the production network (Humphrey and Schmitz, 2002, 2004; Coe et al., 2004). During the 1990s and 2000s, the largest core-based automakers invested heavily in new assembly plants located in the less developed ‘emerging’ economies (Humphrey, 2000; Sturgeon and Lester, 2004). They were attracted by the profit-making potential of export-oriented low-cost production in peripheral regions such as Mexico and East-Central Europe, which are located close to automotive core markets and within regional trade agreements, and by potentially very large domestic markets in rapidly growing economies such as China and India (Humphrey et al., 2000; Pavlínek, 2002c; Liu and Dicken, 2006; Liu and Yeung, 2008; Van Biesebroeck and Sturgeon, 2010).

The geographic expansion of assembly operations and the contemporaneous development of modular design and production (Baldwin and Clark, 1997; Frigant and Talbot, 2005) compelled lead firms to increasingly demand global (follow) sourcing of certain components. Leading Tier 1 suppliers (sometimes referred to as Tier 0.5 suppliers) met this demand by rapidly internationalizing their operations through a wave of mergers, acquisitions and joint ventures in order to quickly develop their ability to supply lead firms wherever they assemble vehicles (Sturgeon and Lester, 2004). These ‘global’ suppliers have also become increasingly specialized in particular technologies and the production of distinct modules (Sadler, 1999), and they significantly enhanced their R&D capabilities. As the differences in capabilities among suppliers increased, the

entire supplier industry has been reorganized into distinct tiers (e.g. Humphrey and Memedovic, 2003; Pavlínek and Janák, 2007). Tier 1 suppliers are the most internationalized and supply modules and the most sophisticated components, which they co-design with lead firms. Tier 2 suppliers are less internationalized and supply lead firms and Tier 1 suppliers with less sophisticated and lower value-added components. Tier 3 suppliers are the least internationalized and supply low value-added, simple, standardized and slow-changing components in the entire GPN.

The internationalization and geographic expansion of leading suppliers and the restructuring of the supplier industry have had important consequences for domestic automotive suppliers in less developed countries. The widespread follow sourcing and the importance of long-term supplier relationships, based upon reputation and trust, favor existing core-based suppliers who are now required to supply lead firms in foreign locations wherever their high-volume final assembly takes place (Humphrey, 2003; Ivarsson and Alvstam, 2005). Domestic firms are typically ill positioned to compete with established foreign suppliers, which are often controlled by large TNCs and are experienced in delivering high quality components in a just-in-time regime in multiple foreign locations (Humphrey and Memedovic, 2003; Meyer, 2004). Experienced foreign suppliers also already possess management and quality expertise required by lead firms and capital to grow rapidly in foreign locations (Humphrey, 2000). As a result, foreign lead firms often develop supplier networks through follow sourcing in less developed host countries consisting almost exclusively of their established foreign suppliers, including Tier 2 and Tier 3 suppliers. Because of high entry barriers, domestic firms find it almost impossible to enter such 'closed' supplier networks, and if they do, they play only a marginal role in them by delivering simple low value-added components (2009–2011 interviews; Barnes and Kaplinsky, 2000). This situation prevents the development of supplier linkages between foreign and domestic firms and consequently prevents the development of vertical spillovers. In the context of the Czech automotive industry, this has been the case of Japanese and South Korean automotive lead firms, which relied on follow sourcing and almost totally excluded domestic companies from their production networks (2009–2011 interviews; see also Sturgeon and Lester, 2004). Hatani (2009) has conceptualized such a situation as 'spillover interception' in which spillovers from foreign to domestic firms fail to materialize in middle-income economies despite high levels of FDI, and which has been supported by empirical evidence found in numerous studies (Meyer and Sinani, 2009). Therefore, although FDI and linkages between foreign and domestic firms are a necessary precondition for vertical spillovers to develop, they do not guarantee that spillovers will occur (Saliola and Zanfei, 2009).

Restructuring of the supplier industry has significantly reduced the number of suppliers (Sadler, 1999). Domestic suppliers who survived the restructuring and consolidation of the supplier industry have become predominantly concentrated in the lowest tiers of the supplier hierarchy (Barnes and Kaplinsky, 2000; Sturgeon and Lester, 2004). Typically, there are only very few Tier 1 domestic suppliers, if any at all, in less developed countries (Pavlínek and Janák, 2007). The number of domestic Tier 2 suppliers has also diminished as these were often taken over by foreign firms during their internationalization drive (Humphrey, 2000, 2003; Sturgeon and Lester, 2004). Although the performance of domestic suppliers tends to improve with their integration into GPNs (UNCTAD, 2001), they usually lack the necessary size and resources to engage in product and process innovation at the scale required by lead firms (Aller et al., 1999; Pavlínek, 2012b). Therefore, they tend to specialize in the supply of simple

standardized components. Their incorporation into automotive GPNs is based mainly on their low-production costs. In such cases, there may be little or no knowledge transfer from foreign to domestic firms even if the domestic firms supply large volumes of components and materials to foreign firms (Saliola and Zanfei, 2009). In many less developed countries, domestic suppliers lack basic capabilities, such as process and project management capabilities or know-how and engineering capabilities that limit their integration into automotive supplier networks (Lockstrom et al., 2011). In such a situation, even a long-term presence of foreign firms in host countries may not lead to the increase in linkages with domestic firms (Saliola and Zanfei, 2009).

The continuous cost-cutting pressure and the emphasis on product quality throughout automotive GPNs stimulate process and product upgrading among suppliers (Humphrey and Schmitz, 2002, 2004). As long as domestic suppliers participate in GPNs, these cost-cutting and quality demands are favorable for the development of vertical spillovers since foreign firms might be willing to help their domestic suppliers achieve desired quality and price of supplied components through sharing some of their broadly defined technology. Spillovers may improve the position of domestic firms in automotive GPNs. More capable and competitive domestic firms could help decrease the dependence of the automotive industry on foreign capital in less developed countries. They can also increase their value creation, enhancement, and capture that are crucial for regional development (Henderson et al., 2002; Coe et al., 2004). Ultimately, this may help enhance the competitive position of the entire economy in the international division of labor. However, the increasing globalization of the automotive industry has led to a decreasing role of domestic suppliers in automotive production networks (Barnes and Kaplinsky, 2000; Humphrey and Salerno, 2000; Humphrey, 2000, 2003; Humphrey and Memedovic, 2003). Consequently, the potential for vertical spillovers has tended to diminish in host economies.

Still, it is difficult to make any general conclusions about automotive suppliers in less developed countries since the nature of the automotive industry and the related opportunities for domestic suppliers depend on a number of different factors, including market size, institutional factors and the distance from developed country markets (Sturgeon and Van Biesebroeck, 2011). However, we think it is safe to conclude that the recent changes in the organization and functioning of automotive GPNs have been unfavorable for the integration of domestic suppliers into these networks. Domestic suppliers tended to be increasingly excluded from the existing GPNs or were unable to integrate in cases of newly developed supplier networks. Such a situation tends to weaken backward linkages between foreign firms and domestic suppliers and undermines the potential for spillovers. On a more general level, it has been argued that changes in the sourcing strategies of automotive TNCs tended to undermine engineering and design capabilities of less-developed countries (Humphrey, 2000, 2003). To investigate these issues in a specific context, we will turn to the analysis of FDI, linkages and spillovers in the Czech automotive industry.

4. FDI effects in the Czech automotive industry

In this section, we argue that large inflows of FDI into the Czech automotive industry in the 1990s and 2000s resulted in strong productivity spillovers but not necessarily in technology spillovers from foreign to domestic firms. We contend that the position of

firms in automotive GVCs and GPNs affects the development of spillovers from foreign to domestic firms.

Our previous work on FDI in the Czech automotive industry, and in East–Central Europe as a whole, highlighted the crucial role of FDI in its post-1990 restructuring (e.g. Pavlínek, 2002a, 2002b, 2002c) and upgrading (Pavlínek et al., 2009; Pavlínek and Ženka, 2011; Pavlínek, 2012b). As of 2012, foreign investors invested more than EUR 8 billion in the narrowly defined Czech automotive industry (NACE 29) making it, together with the real estate sector, the third largest recipient of FDI in Czechia after the banking industry and the wholesale–retail industry (CNB, 2012). By 2008, there were 225 foreign automotive firms employing 135,827 workers in the broadly defined automotive industry.¹ Foreign firms dominate the sector, accounting for more than 90% of turnover, value-added, profit, income taxes, tangible assets and R&D expenditures (Table 1).

The post 1990 economic liberalization and subsequent FDI exposed domestic firms to foreign competition, which introduced much higher standards for the quality of supplied components, quality-management practices, and the timing of delivery (Pavlínek, 2002b, 2003). To quickly achieve new standards, Volkswagen (VW) organized the restructuring of the supplier base of its newly acquired Czech assembler Škoda Auto through follow sourcing and upgrading its domestic suppliers in the early 1990s. Škoda Auto actively encouraged foreign takeovers of its pre-1991 domestic suppliers to transfer foreign technology from foreign (mostly VW's) suppliers. By 2005, 94 joint ventures had been established between Škoda Auto's domestic and foreign suppliers in Czechia and Slovakia (the vast majority of them in Czechia) and foreign suppliers built 58 new factories to supply Škoda Auto (Pavlínek, 2008). Mergers, acquisitions and newly built foreign factories were not limited to Škoda Auto suppliers but affected the entire Czech automotive components industry. In the process, the most capable domestic suppliers were taken over by foreign firms. For VW, foreign acquisitions and joint ventures represented the fastest and most efficient way of transferring foreign technology to the Czech automotive industry. At the same time, Škoda Auto educated its domestic suppliers who remained in domestic hands about the ways of achieving new standards. All its suppliers had to undergo a quality system certification process and pass Škoda Auto's regular quality audits in order to continue supplying. Automotive suppliers have to continuously upgrade their production through better technology, more efficient work organization and management practices in order to survive. Especially lower tier suppliers who supply simple low value-added standardized components can be relatively easily replaced if they are unable to keep up with the relentless competitive pressure in the automotive industry and the ongoing price squeeze by lead firms (Ernst and Kim, 2002). Those Škoda suppliers who could not upgrade quickly were replaced by foreign suppliers (see also De Backer and Sleuwaegen, 2003; Pavlínek, 2003). About two-thirds of original pre-1989 Škoda suppliers stopped supplying Škoda Auto in the 1990s (Pavlínek, 2008).

Although horizontal spillovers were especially negative for the domestic firms that were forced to exit the automotive industry, the exit of uncompetitive domestic firms

1 In addition to NACE 29 firms, the broadly defined automotive industry includes firms from other industrial sectors that are involved in the automotive value chain, such as suppliers from the plastic industry, rubber industry, electrical equipment, and iron and steel industry.

Table 1. Basic indicators of the domestic and foreign firms in the broadly defined Czech automotive industry, 2008

	Domestic	Foreign	Domestic (%)	Foreign (%)
Number of firms	250	225	52.6	47.4
Employment	37,125	135,827	21.5	78.5
Turnover (billion CZK)	62.3	730.0	7.9	92.1
Value-added (billion CZK)	15.4	144.8	9.6	90.4
Profit (billion CZK)	0.7	22.8	3.0	97.0
Wages (billion CZK)	8.7	60.1	12.7	87.3
Income taxes (billion CZK)	0.8	7.4	9.2	90.8
Tangible assets (billion CZK)	16.3	193.2	7.8	92.2
R&D expenditures (billion CZK) ^a	0.6	9.0	6.1	93.9

Notes: Includes firms with more than 20 employees, financial indicators are in constant prices, ^a2007 data.
Source: Authors' calculations based on various databases.

was a necessary part of the restructuring and upgrading of the domestic automotive industry that increased its overall competitiveness and without which it could not have survived in the long run. Crowding out effects of FDI in the Czech automotive industry also need to be understood in the context of changes in the global automotive industry that tended to marginalize domestic suppliers in automotive GPNs (Barnes and Kaplinsky, 2000; Humphrey, 2000, 2003). Those few domestic suppliers in the narrowly defined automotive industry, who survived strong crowding out effects of FDI in the 1990s, benefitted from the rapidly growing automotive production in Czechia and also from exports. In addition to the crowding out of domestic firms, FDI thus strongly encouraged process and product upgrading of those who survived through productivity spillovers (Pavlínek and Ženka, 2011) and indirect spillovers in the form of increased requirements and competition from foreign firms. However, it does not necessarily mean that technological knowledge has been transferred along with the productivity spillovers (Hatani, 2009). We will address this issue in the empirical analysis of spillovers in the Czech automotive industry.

During the 2008–2009 economic crisis, lower-tier suppliers (both domestic and foreign) were further squeezed by assemblers and forced to lower their prices by 10–20% (interview 8 July 2011). Consequently, 15 suppliers went bankrupt or closed their automotive plants in Czechia and four plants were relocated abroad during, and immediately after, the economic crisis (Pavlínek, 2012a). These enormous price pressures contribute to process upgrading but make it extremely difficult for automotive suppliers to engage in functional upgrading (Pavlínek and Ženka, 2011). The economic crisis thus contributed to the further marginalization of domestic suppliers in the automotive supply chain.

These crowding out effects of FDI need to be understood in the context of trade and FDI liberalization and institutional changes related to the political–economic transformation of the 1990s (see Pavlínek, 2002b; Drahokoupil, 2009). Government policies affected potential spillovers from foreign to domestic firms especially in the early 1990s. During the negotiations of the terms of joint venture between Škoda and VW in 1991, the government openly supported the development of linkages between foreign and domestic firms by securing the temporary protection of Škoda's domestic

suppliers. After Škoda's takeover, existing domestic suppliers were granted a transition period during which they continued to supply Škoda but had to gradually achieve VW's quality standards (Pavlínek, 2008). Between 1992 and 1998, however, the government failed to openly support the development of linkages between foreign and domestic firms. In the absence of an explicit industrial policy, the government FDI policies were either completely absent (1992–1997) or limited to the indiscriminate attraction of FDI (1998–2001) (Pavlínek and Ženka, 2011). After 2000, the government began promoting linkages between foreign and domestic firms and links between firms (both domestic and foreign) and universities. Since 1999, CzechInvest, the state investment promotion agency, has operated the 'Supplier Development Program' in order to foster links between foreign and domestic firms and attract more foreign investors in the Czech automotive industry. It consists of the provision of a database of Czech-based (both domestic and foreign) automotive suppliers, including a list of their products and capabilities; the arrangement of links between Czech-based suppliers and incoming foreign investors; and the identification of potential domestic firms suitable for mergers and acquisition (CzechInvest, 2014). Between 2002 and 2013, the government together with the EU spent EUR 42.5m to support the formation and operation of about 60 regional cluster organizations in various industries. These clusters had to have at least 15 members, 60% of them small- and medium-size enterprises, and had to include a university and/or research institute. The Moravia-Silesia automotive cluster is the only cluster formed in the automotive industry. It supports innovation activities, competitiveness and export capabilities of its 62 members (domestic and foreign firms, engineering service providers, universities, technical high schools and a regional development association of producers), through inter-firm cooperation and close links to state and regional institutions (MIT and CzechInvest, 2013). Our survey of 274 automotive firms revealed that only 29% of them were actively involved in some form of cooperation with other stakeholders, such as organized partnerships or clusters. The poor participation of automotive firms has thus limited the potential benefits of these programs in the Czech automotive industry.

5. Backward linkages between foreign firms and domestic suppliers

Our analysis of spillovers in the Czech automotive industry is based on detailed firm-level data collected through personal interviews with senior managers of selected automotive firms and a survey of Czech-based automotive firms. We have drawn on a database of 490 Czech-based automotive firms with 20 or more employees in the broadly defined automotive industry (CSO, 2009) to conduct a survey in 2009, which yielded a response rate of 65% (317 firms). The survey provided firm-level data about linkages between domestic and foreign suppliers in Czechia. The interviews with 100 foreign and domestic automotive firms were carried out by the authors between December 2009 and August 2011 (Table 2). The interviews, in which foreign and domestic firms were targeted with different questions, collected more detailed information about spillovers than the survey and are, therefore, the main source of data for our analysis presented here. A large number of surveyed and interviewed firms at different positions of the automotive value chain yielded a highly representative sample. In-depth interviews allowed us to investigate factors behind spillovers and mechanisms through which they occur. Therefore, in addition to the identification of

Table 2. Basic characteristics of the interviewed and surveyed firms compared to the total database

	Interviewed firms	Surveyed firms	Total database
Total number of firms	100	317	490
Domestic firms	38	162	228
Foreign firms	62	155	262
Assemblers	6	7	8
Tier 1	19	42	52
Tier 2	32	102	149
Tier 3	43	166	281
Small size	8	41	51
Medium size	33	143	233
Large size	59	133	206
Average size	1,056	488	364

Note: Size categories of firms: small firms less than 50 employees, medium-size firms 50–250 employees, large firms more than 250 employees.

Source: Authors' 2009 survey and 2009–2011 interviews, CSO (2009).

different types of spillovers, our qualitative data allowed us to examine their consequences for technological, organizational and strategic competences of domestic suppliers and explain why only certain domestic suppliers have been able to benefit from spillovers. We have classified Czech-based suppliers into tiers based on the sophistication and value-added of supplied components while ignoring their degree of internationalization and their size as criteria for their classification. As opposed to some recent studies (e.g. Giroud et al., 2012), we differentiate between Czech-based foreign firms and domestic firms and analyze their supplier linkages to evaluate the effects of FDI on domestic firms. This distinction is very important since, as we have already shown, foreign firms and domestic firms play very different roles in contemporary automotive supplier networks because of the widespread use of follow sourcing by lead firms.

We have argued that the development of vertical spillovers depends on the existence and intensity of linkages between foreign and domestic firms. Therefore, the starting point of our empirical analysis is the evaluation of linkages between foreign and domestic firms. Czech-based foreign firms were asked during interviews to estimate to what extent they source components and materials from domestic firms, other Czech-based foreign firms and from abroad. We want to emphasize that these figures are based on qualified estimates of respondents rather than the precise data. In most cases, firms do not differentiate among Czech-based suppliers according to their ownership structure. Still, we believe that these qualified estimates are an important source of information about the extent of linkages between domestic and foreign firms. The results, which are summarized in Table 3, show a low share of parts and components sourced from domestic suppliers (13.5%) and a high share sourced from abroad (76.0%). Overall, Czech-based foreign firms sourced 86.5% of their total supplies from other foreign firms supplying both from abroad and from Czechia. This relatively low share of domestic suppliers of the total supplies to Czech-based foreign firms is also supported by the survey data. Out of 146 surveyed foreign firms, 98 (67.1%) reported

Table 3. The average share of the total volume of automotive supplies sourced by Czech-based foreign firms (in %)

	Number of firms	Per cent share of total supplies from		
		Domestic firms	Czech-based foreign firms	Abroad
Total	62	12.6	10.9	76.5
Tier 1	14	13.7	10.8	75.5
Tier 2	21	15.4	7.7	76.9
Tier 3	22	7.0	7.9	85.1
Assemblers	5	20.0	32.0	48.0

Source: Authors' 2009–2011 interviews.

the share of supplies from domestic firms to be less than 25%. Only 21 foreign firms (14.4%) estimated that more than 50% of their total supplies were sourced from domestic suppliers, while almost two-thirds (94 firms) were sourcing more than 50% of their total supplies from abroad (Table 4).

However, 40% (25) of interviewed foreign firms, all of them greenfield investors, reported that the share of domestic suppliers in their total supplies increased since their investment, and 35% (22) reported an increase in supplies from Czech-based foreign firms. This would support the arguments about the gradual development of linkages between foreign and domestic firms and the increasing embeddedness of foreign investors in host economies with time (e.g. Dunning and Lundan, 2008; Dicken, 2011). At the same time, however, seven large formerly domestic firms that were taken over by foreign investors, including assemblers such as Škoda Auto, Avia and Tatra, reported a significant decrease in the share of domestic suppliers of their total volume of supplies. This decrease reflects their integration into GPNs after their foreign takeovers and the importance of centralized sourcing strategies of TNCs. In the process, many traditional domestic suppliers were replaced with the established foreign suppliers of their new foreign owners. In some cases, production increases following the foreign takeover required increases in supplies that undercapitalized small- and medium-sized domestic suppliers were unable to meet. Consequently, their overall share of supplies decreased, or they were replaced by foreign suppliers.² The share of domestic suppliers also decreased because many of them were taken over by foreign firms and, with the change of ownership, became foreign suppliers.

According to our data, foreign Tier 3 suppliers account for 44% of all foreign automotive suppliers located in Czechia. A low share of supplies sourced by foreign Tier 3 firms from domestic suppliers underscores the fact that their assembly operations of simple standardized components were most often set up to exploit lower-labor costs in Czechia, rather than to tap into the local manufacturing expertise. Since simple standardized components are not usually supplied in a just-in-time regime, the

2 13.5% of the interviewed domestic firms lost their former domestic customers after these were taken over by foreign firms (2009–2011 interviews).

Table 4. The distribution of the total volume of automotive supplies sourced by Czech-based foreign firms

Share of supplies (%)	Domestic firms		Czech-based foreign firms		Foreign firms	
	Number of firms	(%)	Number of firms	(%)	Number of firms	(%)
0	22	15.1	49	33.6	13	8.9
1–24	76	52.1	54	37.0	17	11.6
25–49	27	18.5	28	19.2	22	15.1
50–74	17	11.6	10	6.8	40	27.4
75–99	2	1.4	3	2.1	49	33.6
100	2	1.4	2	1.4	5	3.4
Total	146	100.0	146	100.0	146	100.0

Source: Authors' 2009 survey.

proximity of Tier 3 suppliers to assembly operations in Western Europe is less important than low-production costs (Frigant and Lung, 2002; Pavlínek and Janák, 2007; Klier and Rubenstein, 2008). The majority of parts and components for foreign Tier 3 suppliers are now supplied from low-cost countries, particularly China and India, where production costs are significantly lower than in Czechia. As a result, foreign Tier 3 suppliers tend to have only tenuous, if any, linkages with domestic automotive firms (Table 3). At the same time, the main reason behind a low share of domestic suppliers in supplying Tier 1 foreign firms is the relative lack of domestic firms capable of supplying more sophisticated, high-quality components at the price and quantity required by Tier 1 firms (2009–2011 interviews). A small average size of domestic automotive firms (149 workers) compared to foreign firms (604 workers) in 2008 (Table 1) makes it difficult for domestic suppliers to produce components and parts in volumes required by high-volume assemblers and Tier 1 suppliers. As a result, the majority of these components are also supplied from abroad and by Czech-based foreign suppliers (Table 3). At least theoretically, therefore, domestic firms should be in the best position to supply foreign Tier 2 suppliers. However, even in this case, domestic suppliers do not account for a significantly higher share of supplies of foreign firms as they have had increasing difficulties to compete with imports from both lower-cost and more developed countries. A director of a Tier 2 domestic supplier argued in 2011:

Our prices always keep on going down. What cost 10 euros ten years ago costs 4 euros now. However, the greatest decrease was in the past three years during the economic crisis when we got really squeezed by assemblers. More or less, we were included in global sourcing together with the Chinese and Indians, and assemblers squeezed everything out of us that was left (interview, July 8, 2011).

Additional reasons for a low share of domestic supplies to foreign firms are suggested in Table 5. According to foreign suppliers, the most important advantages of domestic suppliers include their geographic proximity, flexibility and low prices. At the same time, the lower quality of their products, together with their smaller size, lower reliability and less competitive prices compared to foreign suppliers are considered to be their most important disadvantages. Suppliers from more developed countries often supply higher quality components at competitive prices despite higher labor costs

Table 5. Strengths and weaknesses of domestic firms according to Czech-based foreign firms

Strengths	No. of firms	(%)	Weaknesses	No. of firms	(%)
Geographic proximity	25	59.5	Product quality	16	39.0
Flexibility	20	47.6	Size	8	19.5
Product prices	12	28.6	Reliability	8	19.5
Communication	5	11.9	Product prices	8	19.5
Transportation costs	3	7.1	Instability	4	9.8
Product quality, know-how	3	7.1	Managerial skills	3	7.3
			Technology	3	7.3
			Financial resources	2	4.9
			Productivity	2	4.9

Notes: 42 foreign firms listed at least one strength and 41 foreign firms listed at least one weakness of domestic firms. Each firm could list more than one strength and weakness of domestic firms.

Source: 2009–2011 interviews.

because of their use of advanced technologies and more efficient, less labor intensive production processes compared to domestic firms.

According to Czech-based foreign firms, the two most important reasons for a low share of supplies sourced from domestic suppliers are the unavailability of particular parts, components and materials in Czechia and the centralized sourcing by foreign lead firms (Table 6). This means that Czech-based foreign firms have no or very limited influence on where their most important supplies are sourced from. When they have a choice, they choose suppliers that meet their price, quality and quantity requirements. The majority of interviewed managers argued that whether suppliers were foreign or domestic was not an important selection criterion. Tier 3 foreign firms are most affected by centralized sourcing and, therefore, have the weakest linkages with domestic firms (compare with Table 3). Even if domestic suppliers are competitive, because of their small or medium size, they are often unable to meet the requirement of centralized sourcing to supply the entire production network of a particular foreign firm. For Tier 1 suppliers, the most important reason for sourcing supplies abroad is their unavailability in Czechia. Examples include electronic components or parts made of advanced plastic materials.

Technology spillovers from foreign to domestic firms should potentially contribute to process and product upgrading of domestic firms which, over time, should be reflected in the gradually increasing quality and sophistication of supplied components by domestic firms. How did linkages between foreign and domestic firms influence domestic firms from the point of view of foreign firms? More than two-thirds of foreign firms argued that their requirements on domestic suppliers were higher than the Czech-industry standards at the beginning of their supplier relationship, especially in terms of quality of supplied parts and components. In 60% of the cases, domestic suppliers were asked to meet specific requirements before they could start supplying foreign firms, especially to undergo technology audits and obtain quality certificates (Table 7). Approximately half of the respondents argued that both the quality (25 responses) and the sophistication (29 responses) of parts and components supplied by domestic suppliers increased over years in response to the increased quality and sophistication requirements of their customers. This empirical evidence points to strong productivity

Table 6. Reasons for sourcing supplies from abroad by Czech-based foreign firms

	Centralized sourcing		Unavailability in Czechia		Low quality in Czechia		Total firms
		(%)		(%)		(%)	
Total	40	64.5	40	64.5	25	40.3	62
Assemblers	4	80.0	4	80.0	2	40.0	5
Tier 1	8	57.1	11	78.6	5	35.7	14
Tier 2	11	52.4	12	57.1	9	42.9	21
Tier 3	17	77.3	13	59.1	9	40.9	22

Note: Each firm could list more than one reason for sourcing supplies from abroad.

Source: 2009–2011 interviews.

Table 7. Requirements on domestic suppliers by Czech-based foreign firms

	Yes		No	
		(%)		(%)
Higher requirements on domestic suppliers than was the domestic industry standard at the beginning of the supply relationship ^a in terms of:	38	67.9	18	32.1
Quality of parts/components	29	51.8		
Production technology	15	26.8		
Timing of delivery	8	14.3		
Domestic suppliers asked to meet specific requirements before they could start supplying	35	60.3	23	39.7
Quality certificate	19	32.8		
Technology audit	18	31.0		
Increase in parts/components quality	14	24.1		
New production technologies	6	10.3		
New machinery	2	3.4		

Notes: a: only at the beginning of investment. These were standard requirements in the automotive industry abroad. Each firm could list more than one from the list of requirements.

Source: 2009–2011 interviews.

spillovers especially at the beginning of supplier relationships between foreign and domestic firms. However, according to foreign firms, no domestic suppliers have upgraded to the extent that would allow them to improve their position in the supplier hierarchy. Not surprisingly, 59% of foreign firms argued that foreign suppliers supply more sophisticated and complex products than domestic suppliers.

The analysis of foreign firms has revealed their limited linkages with domestic firms. While these data suggest that domestic firms only play a marginal role in supplying Czech-based foreign firms, it does not mean that most domestic automotive firms do not supply foreign firms. The low share of domestic suppliers in supplying Czech-based foreign firms corresponds with their low share of the total turnover, value-added and

other financial indicators of the Czech automotive industry (Table 1). Both the survey and company interviews show that the vast majority of domestic automotive firms are involved in supplier linkages with foreign firms. 92% of the interviewed domestic companies supply foreign firms. Therefore, we need to turn to domestic firms for a better understanding of the nature of linkages between foreign and domestic firms and their consequences for spillovers.

6. Spillovers and FDI effects on domestic firms

In the next step, we have analyzed interviews with 37 domestic firms about their linkages with foreign firms and spillovers. Our sample included 20 firms that existed during the centrally planned economy before 1990 and 17 firms that were established after 1990. Five firms were small (less than 50 employees), 20 were medium-sized (50–250 employees), and 12 were large (more than 250 employees). More than half (21 firms, 57%) were classified as Tier 3 suppliers, 11 (30%) were Tier 2 firms, 4 (11%) were Tier 1 firms and there was also one small assembler of buses. Generally, higher-tier suppliers are in a better position to benefit from linkages than lower-tier suppliers (UNCTAD, 2001). Our interview questions were designed to identify horizontal and vertical spillovers based on direct and indirect relationships between foreign and domestic firms.

Overall, 49% of interviewed domestic firms argued that they were positively affected by the entry and operation of foreign firms in the Czech automotive industry, while 19% believed that they were affected negatively and 38% of firms believed that the entry of foreign firms had no effect on them at all. Increased sales, because of new customers among Czech-based foreign firms, was by far the most important positive effect of foreign firms on domestic firms, cited by 70% of domestic firms. In several cases, domestic firms were established to take advantage of the increased demand for parts and components generated by the entry of foreign firms. The increased competition for workers in the local labor market was the most important negative effect of foreign firms on domestic firms cited by 46% of interviewed domestic firms. Only about one-third of domestic firms were negatively affected by product competition from Czech-based foreign firms (Table 8).

Less than half of the interviewed domestic firms were affected by technology spillovers (Table 9). The most important technology spillovers included learning about new technology, new methods of quality management and new organizational and management methods. Domestic firms could experience these spillovers either directly or indirectly. Direct effects refer to the direct active help of foreign firms to domestic firms. Examples include a foreign firm providing production technology to a domestic firm or training managers of domestic firms in quality management. Indirect (demonstration) effects refer to a situation in which domestic firms learned about new technology indirectly from foreign firms, for example, through observation during visits of foreign firms. Indirect spillovers, especially in the form of demonstration effects, played much more important role than direct effects. Technology transfer through workers previously employed by foreign firms affected only 16% of the interviewed domestic firms (Table 9).

Overall, one-third of the interviewed domestic firms experienced some direct spillovers from foreign firms, suggesting the limited significance of direct spillovers for domestic firms (Table 10). Direct spillovers took place especially in those cases when

Table 8. General effects of the entry and operation of foreign firms in the Czech automotive industry on domestic firms according to domestic firms

General FDI effects	Yes	(%)	No	(%)
New customers among foreign firms	26	70.3	11	29.7
Increased competition in the labor market	17	45.9	16	43.2
Increased direct (product) competition	12	32.4	25	67.6
Decreased share of the domestic market	6	16.2	25	67.6

Note: $N=37$. Not all interviewed firms answered all questions.

Source: 2009–2011 interviews.

Table 9. Technology spillovers from foreign to domestic firms in the Czech automotive industry

	No. of firms	(%)	Indirect effect	(%)	Direct effect	(%)
Learning about new technology	16	43.2	15	40.5	4	10.8
Learning about new quality management systems	14	37.8	12	32.4	2	5.4
Learning about new organizational and management methods	12	32.4	10	27.0	4	10.8
Access to new components/parts	10	27.0	9	24.3	2	5.4
Technology transfer through workers previously employed by foreign firms	6	16.2				
Learning about new marketing methods	2	5.4	1	2.7	1	2.7
Firms affected by technology spillovers	17	45.9				

Note: $N=37$. Each firm could be affected by both indirect and direct effects.

Source: 2009–2011 interviews.

Table 10. Direct spillovers from foreign to domestic firms in the Czech automotive industry

	No. of firms	(%)
Quality certificates advise	5	13.5
Management training	4	10.8
Provision of technology (license, sale, etc.)	4	10.8
Blue-collar workers training	3	8.1
Production organization advise	3	8.1
Production inputs	2	5.4
Suppliers connections	2	5.4
Domestic firms with direct spillovers	12	32.4

Note: $N=37$.

Source: 2009–2011 interviews.

foreign firms were interested in sourcing components and parts from domestic firms and domestic firms needed help to achieve the required quality and efficiency of production. These requirements significantly affected domestic firms because 62% of the interviewed domestic firms had to meet such specific requirements before they could start supplying foreign firms. These prerequisites were important especially in the early and mid-1990s when the linkages between domestic and foreign firms began to form and when domestic firms had no prior experience with supplying foreign firms. The most frequent requirement of foreign firms, before entering into the supply relationship with domestic firms, was the possession of an international quality certificate and technological audits (30% of domestic firms). Other requirements, together listed by 32% of domestic firms, included demands to improve the quality of particular parts or components, timing of deliveries and lowering their prices.

The most important negative spillovers experienced by domestic firms were related to increased competition on the local labor market because of the entry of foreign firms. These include the loss of workers because of poaching by foreign firms (40.5% of the interviewed domestic firms), followed by the necessity to increase wages in order to keep up with foreign firms and stay competitive in the labor market (24.3%). These negative spillovers are place specific and are strongly affected by the distance decay effect within particular clusters of automotive production. Additionally, 13.5% of the interviewed domestic firms were negatively affected by the loss of supplier contracts due to the takeover of former Czech customers by foreign firms. No domestic firm reported a worsened access to credit because of the presence of foreign firms, and 27% of the interviewed domestic firms did not experience any negative spillovers from foreign firms.

6.1. Absorptive capacity of domestic firms

How can we explain the limited significance of technology and direct spillovers from foreign to domestic firms in the Czech automotive industry? One possible explanation is the low absorptive capacity of domestic firms (Carrillo et al., 2004). Although absorptive capacity is a 'fuzzy concept' which cannot be empirically measured directly, we use R&D employment of domestic firms and their cooperation with universities and public research institutes as proxy measures to evaluate their absorptive capacity (Humphrey and Oeter, 2000). The R&D employment in domestic automotive firms increased from 292 in 1997 to 585 in 2007 and their R&D expenditures grew by 158%, suggesting an increasing absorptive capacity of domestic automotive firms (CSO, 2009). However, a closer look at the data reveals that out of 250 domestic firms in the broadly defined automotive industry only 69 (28%) employed any R&D workers, 38 (15%) employed more than 3 R&D workers and 14 (6%) employed more than 10 in 2007 (CSO, 2009). The fact that almost three-fourths (72%) of domestic automotive firms employed no R&D workers suggests their low absorptive capacity (see also Pavlínek, 2012b).

Out of 37 interviewed domestic firms, 18 (49%) employed R&D workers and an additional 6 (16%) reported workers in design and engineering, 14 (38%) employed three or more R&D workers and 7 (19%) employed 10 or more. The fact, that 35% of the interviewed domestic firms did not employ any R&D workers and an additional 27% employed only one or two suggests a low-absorptive capacity of the majority of domestic firms. The information collected during interviews also revealed that a

majority of the domestic firms had no links with universities and public research institutes. Ten of the 37 interviewed domestic firms (27%) cooperated with Czech universities on R&D activities in the form of joint R&D projects, product testing and measurements, and by supporting selected university students in an effort to recruit them. Only one interviewed domestic supplier cooperated with a public research institute on joint research projects supported by national R&D programs. The interview data were further supported by the information collected by the survey according to which 19% (31 of 163) surveyed domestic automotive firms were engaged in some form of R&D cooperation with universities. We argue that the low-absorptive capacity of the majority of domestic firms contributes to limited spillovers from foreign to domestic firms and that differences in absorptive capacity contribute to differences in abilities of domestic firms to benefit from potential spillovers from foreign firms.

6.2. Classification of domestic suppliers based on spillovers

In our approach, we combine both the experience of foreign firms with domestic suppliers and the experience of domestic suppliers with foreign firms to investigate spillovers from foreign to domestic firms. Our field work suggests that domestic suppliers are a highly variegated group of firms with different capabilities and a different absorptive capacity whose relationships with foreign firms vary as well as their abilities to benefit from potential spillovers (see also Kohli, 2004; Sturgeon and Van Biesebroeck, 2009; Klier and Rubenstein, 2010). During our interviews, we could clearly see that some suppliers have been able to benefit from spillovers while others have not. Therefore, treating domestic automotive firms as a homogeneous group obscures the complex reality and may lead to generalizations that do not necessarily apply to a significant number of domestic firms. To address this problem, we have categorized domestic firms into four distinct groups based on our interview data about spillovers from foreign firms. These four categories are related to the type of product, the firm's position in the GPN, production and R&D capabilities, and spillover effects (Table 11).

The table suggests that there are only a few (11%) domestic Tier 2 and Tier 1 innovation-oriented and relatively highly capable suppliers (Category 3), including domestic engineering service providers. These firms have a high-absorptive capacity and are, therefore, able to benefit from spillovers. All domestic firms classified in this category were affected by horizontal spillovers, especially through demonstration effects in terms of learning about new management systems and new technology, access to new technology, and through increased market opportunities provided by Czech-based foreign subsidiaries and through exports. Supplier linkages played an important role in transferring information and knowledge from foreign firms about quality requirements and new delivery systems. The majority of these domestic firms have begun to internationalize their production by setting up subsidiaries abroad. For example, according to the director of a large domestic supplier (2300 workers) of door and cockpit systems, R&D is its most important source of competitiveness. In 2011, it employed 150 R&D workers. Since the early 1990s, the company has learned 'everything' from foreign firms through supplier linkages, although it did not receive any direct technical, management, financial or procurement assistance from foreign firms. Its turnover increased ten times between 1990 and 2011. Today, it supplies all of the major assemblers with the exception of Nissan and Hyundai/Kia. It is one of the very few domestic suppliers that have tentatively begun to internationalize by setting up small subsidiaries

Table 11. Categorization of domestic firms based on spillover effects in the Czech automotive industry

	Category 1 (<i>N</i> = 10, 27%)	Category 2 (<i>N</i> = 21, 56.8%)	Category 3 (<i>N</i> = 4, 10.8%)	Category 4 (<i>N</i> = 2, 5.4%)
Type of product	Standardized, simple, low value-added parts based on detailed customer specifications (e.g. castings), products designed by customers	Higher value-added and more complex products/components that may be partly based on in-house development (e.g. bearings, engine components, bus and truck chassis)	Final parts/components based on in house know-how and R&D	Final parts/ components that may be based on in-house know-how and R&D
Position in GPN	Captive Tier 3 suppliers	Tier 3 and Tier 2 suppliers	Tier 2 and Tier 1 suppliers	Tier 2 and Tier 3 suppliers
R&D activities and absorptive capacity	None or only technical support of production and/or simple technical construction	Mostly technical development and engineering focused on incremental process and product development	Development of new products, material development, engineering, process innovation	Product development, production process development
Capabilities	Firms with R&D workers: 20% College-educated workers: 5.2%	Firms with R&D workers: 48% College-educated workers: 16.0%	Firms with R&D workers: 100% College-educated workers: 21.9%	Firms with R&D workers: 50% College-educated workers: 10.7%
	Operational	Duplicative	Adaptive and innovative	Duplicative
	<ul style="list-style-type: none"> • Basic manufacturing skills • Quality control • Maintenance and procurement capacity 	<ul style="list-style-type: none"> • Expansion of production through investment • Purchase and use of external technologies 	<ul style="list-style-type: none"> • Adaptation and improvement of external technologies • Development of new technical, engineering and design skills • New products and processes developed through formal R&D activities 	<ul style="list-style-type: none"> • Expansion of production through investment • Purchase and use of external technologies

(continued)

Table 11. Continued

	Category 1 (<i>N</i> = 10, 27%)	Category 2 (<i>N</i> = 21, 56.8%)	Category 3 (<i>N</i> = 4, 10.8%)	Category 4 (<i>N</i> = 2, 5.4%)
Spillover effects	<p>Passing by Only a <i>potential</i> for spillovers through:</p> <ul style="list-style-type: none"> • Demonstration effects: access to new technology and quality control • Direct effects through purchasing/leasing technology <p>Missing endogenous competencies and absorptive capacity to fully benefit from the inclusion in GPNs. Supplier assets and capabilities do not match the needs of TNCs.</p>	<p>Enhancement Mixture of different spillovers through:</p> <ul style="list-style-type: none"> • Demonstration effects: access to new technology, organizational, management and marketing methods; references • Direct effects: management training, support in search for new suppliers 	<p>Interactive Prevalence of demonstration/indirect spillovers through:</p> <ul style="list-style-type: none"> • Pressure put on quality, delivery and in-house development • Co-design with customers <p>Complementarity and coupling between the supplier and opportunities provided by links with foreign investors and the integration into GPNs</p>	<p>Negative Predominantly negative direct spillovers through:</p> <ul style="list-style-type: none"> • Direct competition • Employee poaching

Source: The authors

in Russia, China and South Africa. It is also one of the very few domestic companies that, according to its director, improved its position in the supplier hierarchy from Tier 3 to Tier 2 in the past 20 years (interviews on 24 June 2005 and 8 August 2011).

A small group of capable domestic firms (5%; Category 4) has been strongly affected by negative direct horizontal spillovers, especially in terms of employee poaching and direct product competition. Still, these firms have survived FDI's crowding out effects by switching to new products and new markets. For example, a domestic supplier of fuel injectors for diesel engines has been negatively affected by a foreign Tier 1 firm that set up three subsidiaries to produce fuel injection systems in the same town in order to tap into the domestic firm's skilled labor force and low-labor costs in the 1990s. Its three subsidiaries were generously supported by government investment incentives for every newly created job and by tax holidays. They actively recruited workers of the domestic firm by offering higher wages and openly preferring them to other job applicants. By 2005, they were employing about 5000 workers in the region. Out of these, about 3000 workers were trained by and formerly worked at the domestic firm. The domestic firm lost its most qualified and skilled workers despite substantially increasing wages. It also lost its market share to its foreign competitor and was forced to completely abandon supplying the automotive industry. In order to survive, it has specialized in the production of injection pumps and fuel injection systems for agricultural and construction machinery. Its employment dropped from 6000 workers in 1989 to 1900 in 2011 and the number of R&D workers declined from 92 to 25 between 1995 and 2011. R&D capabilities and the related absorptive capacity of the domestic firm were crucial in switching to new products and new markets (interviews on 11 July 2005 and 11 April 2011).

About one-fourth (27%) of the interviewed domestic suppliers (Category 1) is unable to benefit from direct vertical spillovers because of their low capabilities and low capacity to effectively absorb knowledge from foreign firms (Ernst and Kim, 2002). These Tier 3 suppliers have low competencies that are limited to simple manufacturing and assembly operations and they supply standardized, simple, low value-added parts and components based on detailed customer specifications. The absence of R&D functions in 80% of these firms and a low share of college educated workers are important indicators of their low-absorptive capacity (Cohen and Levinthal, 1990; Giroud et al., 2012). The low-absorptive capacity of these domestic firms prevents them from exploiting potential direct spillovers from foreign firms which, in turn, prevents them from narrowing their gap behind foreign firms. As a result, these domestic suppliers experience the 'spillover interception' (Hatani, 2009). For example, a Czech-based subsidiary of a foreign Tier 1 firm (AB) outsourced the low-volume production of its older spare parts to a medium-size domestic firm which was established in 2000 and employed 60 workers at the time of the interview. AB also helped the domestic firm to launch the production of these spare parts by providing its old production line, helping to organize the production, assisting with achieving the quality certificate, and by providing the administrative support. It also helped the domestic firm to establish links with its existing suppliers. In other words, the domestic firm benefited from the direct knowledge transfer from AB in the form of technical assistance, the provision of various information and administrative assistance (see Giroud et al., 2012). Consequently, its number of employees increased 12 times, its revenues 13 times, but its value added only 2.7 times between 2000 and 2010. At the same time, however, despite this help, the domestic supplier has failed to develop its own know-how, it has been unable to fully

absorb the technology provided by AB and has remained strongly dependent on AB, which buys more than 90% of its output. AB taught its domestic supplier how to use its technology to produce spare parts but since it is too advanced for the domestic firm, it does not fully understand its know-how and it does not engage in any R&D activities on its own. In other words, technology has been transferred, which significantly increased AB's productivity (productivity spillovers), but technological knowledge has not, indicating the absence of technological spillovers. Although the domestic firm has learned a lot through its cooperation with AB and it has been growing, it remains a typical captive Tier 3 supplier producing simple standardized low value-added spare parts and remains highly dependent on AB, its key customer (interview on 25 March 2011) (see also Gereffi et al., 2005).

Tier 3 and Tier 2 suppliers who supply various automotive parts and components that are *partly* based on their in-house process and product development represent the most numerous category of the interviewed domestic suppliers (57%; Category 2). These suppliers have employed foreign technology and invested in the expansion of production in order to tap into the increased demand for automotive components in Czechia and abroad. Their higher absorptive capacity, which is also indicated by a higher presence of R&D functions (in 48% of the firms in the category), allowed them to benefit from various horizontal and mainly indirect vertical spillovers through backward linkages with foreign firms and through demonstration effects. They gained a valuable experience by supplying foreign firms which they used to win contracts to supply other foreign firms both in Czechia and abroad. Overall, they have been able to keep up with competition through process and product upgrading in their particular tier but unable to improve their position in the supplier hierarchy. Some of these domestic firms benefited from direct vertical spillovers from foreign firms. For example, a large domestic supplier of metal castings (300 employees) received direct knowledge transfer from foreign firms in order to meet their requirements after it was selected to supply them. Prior to the start of the supplier relationship, foreign firms sent their experienced process engineers to the domestic firm for up to one week to improve its production processes in order to ensure 100% reliability of their future supplier. Although foreign firms offered this help free of charge, any resulting savings were split between the domestic firm and the foreign firm providing help. The domestic firm learned how to improve the quality of its products, the reliability of its machinery and how to streamline its production through supplier linkages with foreign firms. At the same time, it has been actively upgrading its production processes and its products in order to increase its competitiveness. The domestic firm designs its own machinery and it has gradually shifted from the production of castings to work pieces and preassembled simple modules that now account for 20% of its output (interview on 17 December 2009). However, it is important to note that such examples of direct knowledge transfer from foreign to domestic firms have been mentioned very rarely during our interviews (Table 10), suggesting that, overall, they do not play a very important role in the Czech automotive industry.

7. Conclusion

Our analysis has identified diverse spillover effects from foreign to domestic firms in the Czech automotive industry. Although econometric studies have mostly found either

statistically insignificant or negative horizontal spillovers from foreign to domestic firms in East–Central Europe (Djankov and Hoekman, 2000; Jarolím, 2000; Kinoshita, 2001; Konings, 2001; Görg et al., 2006), our firm-level qualitative data suggest that both positive and negative horizontal spillovers have affected domestic firms. Negative horizontal spillovers, especially in the form of increased competition and increased quality requirements, led to strong crowding out effects that forced the majority of domestic firms to be either acquired or form joint ventures with foreign firms or exit the automotive industry in the 1990s. The domestic firms that survived these challenges benefited from positive horizontal spillovers, especially from demonstration effects, imitation and increased access to both domestic and international markets to upgrade their products and processes and become integrated in automotive GPNs. This suggests that negative horizontal spillovers played the most important role after the entry of FDI but may only be temporary, although some negative horizontal spillovers, such as employee poaching and increased labor market competition, continue to negatively affect domestic firms. It also suggests that positive horizontal spillovers affected those domestic firms that survived the original restructuring of the 1990s (see also Kosová, 2010). Overall, at least in terms of the extent of impact, horizontal spillovers in the form of increased product and labor market competition, quality requirements, demonstration effects and market access have played a more important role than vertical spillovers in the Czech automotive industry after 1990 because they affected the vast majority of domestic automotive firms. This finding challenges the conclusion of Geršl (2008, 243), who found vertical spillovers to be ‘much more important’ than horizontal spillovers in the Czech manufacturing industry as a whole.

Vertical spillovers from foreign to domestic firms were more selective than horizontal spillovers. Our analysis of linkages between foreign and domestic firms revealed that Czech-based foreign firms source 86.5% of their total supplies from other foreign firms both from abroad and from Czechia and only 13.5% from domestic suppliers. The most important reasons for a low share of supplies from domestic firms include the centralized sourcing by automotive TNCs, the unavailability of particular materials or parts in Czechia and often a low quality of supplies by domestic suppliers. These reasons tend to outweigh the advantages of geographic proximity, flexibility and often lower prices of domestic firms. However, a low share of domestic suppliers does not mean that linkages between foreign firms and domestic firms are weak because the low share of domestic suppliers corresponds with their low share of the total output of the Czech automotive industry. Almost all interviewed domestic firms were to a greater or lesser extent integrated into automotive GPNs through their supplier linkages with foreign firms, which is the basic precondition for the development of vertical spillovers. Our data point to strong productivity spillovers from foreign to domestic firms especially at the beginning of their supplier relationships. This is because, in most cases, foreign firms imposed higher requirements on domestic firms with respect to quality and sophistication of supplied parts and components than was the industry standard in Czechia. However, despite the integration of domestic firms into GPNs and strong supplier linkages between domestic and foreign firms, we have found that only less than half of the interviewed domestic firms reported any technology spillovers from foreign firms and only one-third experienced direct technology spillovers. In other words, while linkages between foreign and domestic firms are an important precondition for vertical spillovers to occur, there is no guarantee that vertical spillovers will actually develop in the presence of these linkages. One plausible explanation of weak vertical spillovers

from foreign to domestic firms is the low absorptive capacity of domestic firms, which is suggested by a high share of domestic firms with no R&D capabilities and by the weak links of domestic firms with universities and public research institutes.

We acknowledge the limitations of our analysis that has focused on the existing domestic firms. A part of the explanation of weak direct vertical spillovers may lie in the fact that the majority of most capable domestic suppliers were taken over by foreign firms in the 1990s and 2000s. These former domestic firms benefited from direct transfers of technology and know-how from their new foreign owners. At the same time, we did not investigate domestic firms that did not survive and that might have experienced strong negative spillovers from foreign firms. Our focus on the existing domestic firms would thus tend to underestimate the real extent of both positive and negative FDI effects on domestic firms.

Our research suggests that the failure to consider the heterogeneity of domestic firms may lie behind many inconclusive results of various analyses about spillovers from foreign to domestic firms as these effects can significantly differ among different firms or groups of firms. Consequently, it makes it almost impossible to generalize the effects of spillovers on technological, organizational and strategic competences of domestic firms as a whole. Therefore, instead of treating domestic firms as a homogeneous group, we classified them into four basic types. Our classification shows large differences in the capabilities and absorptive capacity of domestic firms which significantly influence their ability to benefit from spillovers.

Our research also shows how the particular nature of GPN influences the potential of domestic firms to benefit from linkages and spillovers in the form of improving their overall position in the value chain. In our case of the quasi-hierarchical value chain, even direct positive spillovers did not help domestic firms improve their position in the supplier hierarchy. As a result, the vast majority of domestic automotive firms remain locked in subordinate positions as Tier 3 and Tier 2 suppliers in automotive GPNs dominated by foreign lead firms. Consequently, despite high levels of FDI, domestic firms continue to lag behind foreign firms (Peter et al., 2012) with limited chances to significantly improve their position in the automotive value chain and become major competitive players in the Czech and European automotive industry. Given this inability to close the gap between themselves and foreign firms and given the contemporary nature of the global automotive industry and limited technology spillovers from foreign firms, the marginalized and vulnerable position of domestic automotive suppliers of less developed countries in the automotive GPNs is likely to persist in the foreseeable future.

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