Varieties of Capitalism and technological inventive capacity in Central Europe:

The case of Hungary

CASE Conference 17-18 November 2016

Eric Rugraff, Robert Schuman Institute of Technology and BETA research center, University of Strasbourg, France

Magdolna Sass, Centre for Economic and Regional studies, Hungarian Academy of sciences, Pecs, Hungary

Eric Rugraff is associate professor in international economics at the University of Strasbourg and researcher at the BETA. His research concentrates on transition economics and strategy of multinational corporations. He published books and numerous articles in international journals such as Regional Studies, Post-Communist Economies, Europe-Asia Studies.

Magdolna Sass is a senior research fellow at the Centre for Economic and Regional Studies, Institute of Economics, Hungarian Academy of Sciences. Her main research topics are inward and outward FDI and related policies in East-Central Europe. Her latest publications include articles in Europe-Asia Studies and Post-Communist Economies.

1. Introduction

In centrally planned economies, firms were far less technologically inventive and innovative than in developed countries although the former shared with the latter the existence of a strong industry base as well as a well-educated labor force. Once the communist system was fallen and the Central European countries engaged in a free-market oriented transition, most liberal economists were rather optimistic about the capacity of the Central European countries to catch-up technologically with the EU countries (Meyer, 1995). When in the middle of the 1990s FDI (Foreign direct investment) rushed massively to Central Europe, thanks to the adoption of 'open doors' FDI policies (Rugraff, 2008), economists were all the more confident in technological catch-up. Many of the largest local companies were bought by foreign investors, integrated into the multinational firms' networks and equipped with state-of-the art technologies. The presence of advanced knowledge was expected to spill over to the rest of the economy. However, it does not happen except for some solitary cases. A quarter of century after the fall of the Berlin Wall even the most advanced post-transition countries still lack inventive firms.

The main hypothesis of this paper is that the absence of inventive companies in the Central European countries results from their specialization since the 1990s in FDI-managed assembling activities of semi-standardized goods. This initial specialization created a path-dependent model of development. Major industries such as the automobile and electronics progressively structured around these assembling activities.

Different theoretical frameworks can provide the analytical tools to study how multinational firms shape the local industrial structure, and more specifically technology creation. The Global Value Chain framework for example adopts a sectoral perspective and analyses – through the five models of Global Value Chain governance – how different value chains are governed and change (Gereffi et al., 2005). Global Value Chain research acknowledges the increased importance of networked multinational firms as part of global trade overall. In this paper, we adopt an alternative framework, the Varieties of Capitalism (VoC) approach, initially developed by Hall and Soskice (2001). The VoC approach is, like the Global Value Chain framework, actor-centered and adopts a relational view of the firm. However, the VoC approach belongs to the institutionalist school of thought. In the institutionalist way of thinking, the economic agent's behavior, and hitherto the idiosyncratic industrial organization of a country, is shaped by rules, norms and beliefs surrounding the economic activity. The institutional settings determine how the firms deploy strategic interactions with their different stakeholders. In return, the deployment of the strategic interactions of the firms also shapes the institutional context in a country (Berger et al., 2001). Causality is bi-directional. Carney et al. (2009, pp.369-370) for example, suggest that firm strategy collectively and intentionally feeds back to shape the institutional structures by (1) filling institutional voids[1], (2) retarding institutional innovations[2], and (3) deploying institutional escape.[3]

In Central Europe, the collapse of the centrally planned economy and the following transition period created a major institutional disruption (Roland, 2002). The gap left by the destruction of institutions and rebuilding of new ones allowed a category of actors, the multinational firms, to behave with a large freedom. Because the Visegrad group of countries – the Czech Republic, Hungary, Poland, Slovakia – chose to give the multinational firms the prime position in the countries' economic transformation, these actors have become the dominant national and regional actors (Hunya, 2000). The leading role played by the multinational firms in the Visegrad group of countries has been exacerbated through the adoption of 'open-doors' policies and the building of institutions geared towards the preferences of these corporations. Central European governments pursued permissive policies to attract FDI and have strictly limited the performance requirements, while providing foreign investors with different types of incentives (Rugraff, 2008). Since the multinational firms faced no obstacle in the organization of their activity in the host countries, they imposed an organization of their activity inside their boundaries and with the local industry that perfectly fits their needs. The domination of FDI over the Central European economies led to the creation of an original variety of capitalism, the 'Dependent Market Economies', characterized by a specific type of comparative advantage which is not based on radical or incremental innovation, but rather on an assembly platform for semi-standardized industrial goods (Nölke and Vliegenthart, 2009).

The assembly platforms use inventions that are made in the multinational firms' headquarters (Nölke and Vliegenthart, 2009). Innovation is transferred within the multinational network and strictly controlled, which eliminate risks of intellectual-property-rights leakages. Since the subsidiaries in Central Europe are specialized in the assembling of

[1] For example, business groups are created to reduce severe transaction costs resulting from market failures.

[2] For example, internal capital markets as an allocation mechanism reduce the necessity to develop external capital markets.

[3] For example, offshoring production can be a response to onerous regulatory requirements.

industrial goods, there is neither need for investing in intensive R&D activities nor for the development of a comprehensive education system which would promote general skills or vocational training. The influence of FDI is not limited to the boundaries of the multinational firms. FDI also plays an important structural role in the rest of the economy: given the poor technologically-innovativeness content of the subsidiaries' production, the subsidiaries of multinational firms do not buy high technology products from local firms and local suppliers are mainly selected on cost considerations.

Most articles describing the dominant type of capitalism in Central Europe belong to the political science literature (Eyal et al., 1998; Bohle and Greskovits, 2007; Lane and Myant, 2007). They mainly provide a systemic articulation of the model, but are poor in terms of empirical material to confirm their theoretical predictions. Our paper aims at filling this gap. The objectives of the paper are threefold: firstly, to assess and analyze the position of the multinational firms in technological creation in Central Europe. Secondly, to assess and analyze the technological specialization of the subsidiaries of multinational firms in Central Europe; Thirdly to study the multinational firms' role in the technological inventiveness of the indigenous firms.

Methodologically, we use two databases – OECD database and AMADEUS database – to determine empirically the technology creation, by working on R&D expenditures and patents, in one Central European country: Hungary. We chose to focus on Hungary because: (i) Hungary was the first country, among the Central European countries and among all the former communist countries in East Europe, to open its economy to foreign investors; (ii) Hungary is the Central and Eastern European country with the highest share of FDI in national indicators such as employment, exports, value added.[4] Over 80% of the 66 largest firms in Hungary belong to foreigners.[5] (iii) FDI plays a very important role in innovative activities in Hungary: in 2009, foreign direct R&D represented roughly half of R&D business personnel and of business R&D expenditure in the manufacturing industry (OECD, 2016). Hungary can therefore be considered as an ideal type of the Dependent Market Economies, where multinational firms play the leading role in invention and innovation.

Finally, we test four hypotheses:

Hypothesis 1*: the subsidiaries of multinational firms in Hungary do not invest in technologically inventive activities because they have no mandate in terms of basic research and applied development;*

*The correlative **Hypothesis 2** is that inventive R&D is a strategic asset which remains located in the home country of the multinational firm;*

Hypothesis 3*: the Hungarian firms' inventiveness is too weak to incite the headquarters of multinational firms to transform the local subsidiaries' mandate in terms of technology;*

*The correlative **Hypothesis 4** is that transfer of technology through FDI towards indigenous firms remain poor.*

[4] In 2013, subsidiaries of multinational firms represented 48.3 % of the employment, 67.3 % of the value added and 70.4 % of turnover in the manufacturing industry (OECD, 2016).

[5] These 66 Hungarian firms belong to the 500 largest firms in Central and Eastern Europe (Deloitte, 2015).

2. Theoretical background

In this paper we adopt the Varieties of Capitalism (VoC) approach, which belongs to the numerous institutionalist line of thought (Amable, 2000). The VoC approach was elaborated for developed countries. Within the developed countries, the VoC approach distinguishes two main ideal types of national political economies: the Liberal Market Economies (LME) where firms coordinate their activities primary through hierarchies and competitive market arrangements and the Coordinated Market Economies (CME) which rely more heavily on non-market relationships to coordinate the activities. The extant literature tends to show that the VoC dichotomy is not applicable to the rest of the world and asks whether distinctive varieties of capitalism exists as well in other areas, especially Asia, Latin America and Eastern Europe. In Asia, the literature tends to suggest that there is no unique form of capitalism but several forms of Asian capitalisms that are fundamentally different from the Western types of capitalism (Carney et al., 2009; Witt and Redding, 2013). Schneider (2009) also identifies a specific form of capitalism in Latin America (the Hierarchical Market economies, HME). In Eastern Europe, the variety of capitalism also differs dramatically between the former USRR and the new members of the EU. Some authors identify distinctive varieties of capitalism that gather several countries. Lane and Myant (2007) and Nölke and Vliegenthart (2009) consider that the Visegrad Group (the Czech Republic, Hungary, Poland and Slovakia) presents common institutional characteristics and form a distinctive VoC, the Dependent Market Economies (DME).

In the VoC model, firms deploy strategic interactions in five main spheres: industrial relations, vocational training and education, corporate governance, inter-firm relations and with their own employees. These five spheres represent the institutional settings in which firms have to resolve their coordination issue. The five spheres are also influenced by the behavior of the firms.

In this paper, we depart from Nölke and Vliegenthart's (2009) work which identify a specific family of capitalism in the Visegrad group of countries: the Dependent Market Economy (DME) type of capitalism. This type of capitalism differs fundamentally from the Western LME and CME types, but presents some common features with the Hierarchical Market Economies (HME) type of Capitalism. We chose therefore to compare these two types of capitalism (See Table 1). The comparative approach will help us to stress the specificities of the Visegrad type of capitalism.

Distinctive coordination mechanism

Hierarchical Market Economies and Dependent Market Economy resemble Coordinated Market Economies in non-market forms of corporate governance, especially in the group-based coordination of the sort found in Korea and Japan. In Latin America and in Central Europe, the firms do not rely principally on market mechanisms to resolve the coordination problems: the coordination of economic activities are neither state-led nor market-led but rather business-led. However, Latin America differs with Central Europe regarding the actors who shape the economy. In Latin America two groups of actors dominate the economy: on the one hand, diversified indigenous business groups which belong to families, and on the

other hand subsidiaries of [foreign-owned] multinational firms. In Central Europe, [foreign-owned] multinational firms represent the sole dominant actor. Conglomerated family-owned groups – which is rather common in the developing world (Khanna and Yafeh, 2007) – are quasi-absent in Central Europe. The specificity of the Visegrad Group can be clearly apprehended in the Deloitte (2015) survey of the major firms: two thirds of the 350 largest firms in the four countries belonged in 2015 to foreign investors. Paucity of family-owned groups can be explained by the destruction of the private form of capitalism operated by the communist regime and by the privatization modalities centered on FDI that the Central European governments engaged in the 1990s (Roland, 2002).

Corporate governance

In the Liberal Market Economies (LME), firms primary raise capital on the financial market. Firms must therefore be attentive to current earnings and the prize of their share on equity market (Hall and Soskice, 2009). In the Coordinated Market Economies (CME) dense networks, linking firms between them (cross-shareholding) and with banks, represent the primary mean of raising capital. Finance is not only dependent on balance-sheet criteria, but also on 'inside' information shared in the networks linking firms with their banks, suppliers, clients and joint membership in active industry associations. In the LME major corporate decisions are negotiated between managers and shareholders whereas in the CME they are negotiated with the stakeholders. In the Dependent Market Economies (DME), decisions are imposed from the top of the organization – the multinational firms's headquarters – to the management of the Central European subsidiary. The headquarters can organize the financing of the subsidiary through different means: internal in the form of inter-subsidiary credits, reinvestments of the subsidiary's benefit, external by credits from foreign-owned banks, or even other forms of capital raising on international markets.

Industrial relations

Firms have to negotiate wages and work conditions with their labor force and the organizations that represent labor. Liberal Market Economies (LME) are characterized by deregulated labor markets with low costs of hiring and firing. In Coordinated Market Economies (CME), trade unions and employer associations coordinate bargaining across the economy. Dependent Market Economies (DME) and Hierarchical Market Economies (HCE) present common features: labor market regulation is, on books, more extensive than in LME (OECD, 2004, p.117) and labor relations are atomistic. The communist period has passed on the Eastern and Central European countries a firm culture lacking dialogue and participation. The politicization of labor unions combined with their incapacity to represent workers has been at the origin of the collapse of unionization and prompted multinational firms to engage in direct bargaining with workers. Bargaining takes place directly at the subsidiary level between the employee and the employer. This means much freedom for the multinational firms in the setting of wages and in the discussion of working conditions (Rugraff, 2006).

Vocational training and education

Firms have to secure a workforce with suitable skills, while workers must decide how much to invest in what skills. Vocational education and technical training play an important role in Coordinated Market Economies (CME). They are therefore endowed with firm-specific and/or industry-specific human capital. Liberal Market Economies (LME) promote investments in general skill facilitating the mobility of the workers. The DME type of capitalism characterizing Central Europe differs from the Western CME/LME variants but also from the Latin American type of capitalism. In the HME, the education levels are low and firms do not invest in vocational training at the work place. In the DME, the education levels of the workers are relatively high, but multinational firms only poorly invest in vocational training. Few vocational training at the work place in Central Europe can be explained by the specialization of the subsidiaries of multinational firms in assembling activities of semi-standardized goods which do not require additional skills. Multinational firms will not be in favor of a generous public education system because they would have to pay more tax for the 'production' of qualified people they do not need.

Inter-firm relations

In LME inter-firm relations are mainly based on standard market relations and enforceable formal contracts whereas in CME the standard market relations coexist with long-term collaborative relations. Cooperative relations give rise to a 'relational quasi-rent' (Aoki, 1988) owing to the emergence of relation-specific economic return that the partners would lose if they stopped their collaboration. In Central Europe, the subsidiaries of multinational firms have promoted standard market relations with indigenous firms. Three main reasons explain their preference for fluid relationships with the indigenous firms. Firstly, unit labor costs are a central determinant of foreign direct investment in Central Europe (Bevan and Estrin, 2004). Arm's-length relationships foster cost cutting behavior and increase the benefits from competitive switching. Secondly, technological capacities of the local firms are too limited to incite the subsidiaries to build cooperative relationships with them (See *infra*). Thirdly, the subsidiaries were not given the mandate to enter into cooperative relationships with the local industry.

Employees

The firms' central problem is to ensure that the employees have the requisite competencies and that they cooperate well with others. In CME, workers with firm-centered skills and high level of corporate commitment are protected by long-employment tenures whereas LME permits mobility across companies and industries. In LME, the possession of good general skill facilitates mobility of people and their adaptation to a new business environment. In the Latin American model of capitalism (HME) workers have few general skills and are not given time to develop skills specific to a firm. In the DME, the subsidiaries of multinational firms incite the workers to invest in skills which are specific to the subsidiary/multinational by

offering long-term tenures as well as by paying higher wages than in the indigenous firms. Although DME share common features with CME regarding the employees' coordination issue, they basically differ in the bargaining position of the employees towards their employers. In the CME, employees are relatively protected by the governance system and industrial-relations system, whereas in the DME in Central Europe, the multinational firms are in a dominant position towards employees engaged in disintermediated bargaining for wages and working conditions.

Table 1. Strategic interactions in the Dependent Market Economies (DME) and Hierarchical Market Economies (HME) type of Capitalism

	HME in Latin America	DME in Central Europe
Countries concerned	**Most of the Latin American countries**	**Czech Republic, Hungary, Poland, Slovak Republic**
Distinctive coordination mechanisms	**Business-led**	
	Family-owned groups and multinational firms	**Multinational firms**
Corporate governance	**Familial management and headquarters of multinational firms**	**Headquarters of multinational firms**
Industrial relations	**Plant-level and company-level coordination over wages and working conditions**	
Vocational training and education	**No vocational training at the work place** **Low education level**	**Few vocational training at the work place** **Relatively high education level**
Inter-firm relations	**Standard market relationships of the subsidiaries of multinational firms with indigenous firms**	
Employees	**Few general skills** **Few specific skills** **High turnover**	**Firm-specific skills** **Long-term tenures**

Sources: Rugraff, 2006; Nölke and Vliegenthart, 2009; Schneider, 2009.

3. Methodology

We already explained in the introduction why we chose Hungary as an ideal-type for the study of technology creation in Central Europe.

The production of technology has changed with the emergence in the 20th century of a professional R&D system (Freeman and Soete, 2007). There are still inventions made by

people as a result of direct observation or small-scale experiment, but the bulk of technological innovation is attributable nowadays to research and development work performed in specialized laboratories or pilot plants by full-time qualified staff. Large firms, which have set up their own full-time specialized R&D sections or departments, represent the dominant part of technological invention in the world (UNCTAD, 2005).

We begin by working on R&D information provided by the OECD Statistics Database (2016). We use the OECD Statistics Database, Section 'activity of multinationals', to benchmark the R&D performance of the subsidiaries of multinational firms in Hungary with the multinational firms' performance in Germany and other Western European countries. One can consider that static and dynamic data of R&D expenditures and R&D personnel determine the technological inventive capacity of a firm.[6] Our R&D study is focused on the four industries which concentrate the bulk of R&D personnel and intramural R&D expenditure of the subsidiaries of multinational firms in the Hungarian manufacturing industry (OECD, 2016): manufacture of computer, electronics and optical products (ISIC Revision 4, Division 26), manufacture of electrical equipment (Division 27), manufacture of machinery and equipment (Division 28) and manufacture of motor vehicles, trailers and semi-trailers (Division 29).

We then use patent figures. Because patents result from the firm's investments in basic research and applied development, patent data can be considered as a good proxy of the firm's genuine inventive activity.[7] We use the AMADEUS database of the Bureau Van Dijk which contains financial information of companies in Western and East Europe. Unfortunately, the database does not provide information on the activity of multinational firms outside Europe. The database contains information on ownership and patents (patentee, inventor, etc.). Patent analysis will allow us to evaluate the genuine technological inventive capacity of the subsidiaries of multinational firms in Hungary as well as of Hungarian firms.

Determining the country of origin of an invention is often complex:

Firstly, because multinational firms have an incentive to locate their patents at subsidiaries with low corporate tax rates. A multinational firm can organize a geographical separation between the place where the inventor made his/her invention (for example in a subsidiary in Hungary) and the location of the patent (for example in the headquarters' country). The Benelux countries introduced 'patent boxes' – policies that sharply reduce the rate of corporate tax applied to income derived from patents – which artificially increased the Benelux's share of patent holdings. In a study focused on European multinational firms, Karkinsky and Riedel (2012) found that the location of the inventor and the applicant differed roughly in 10% of the cases.

We therefore worked on 'the place where the inventors made their innovation' when we suspected a strategy of separation, that is to say when the separation between the location

[6] This type of indicators represents only an imperfect proxy of the inventive capacity of a firm. It is very difficult to measure business R&D activities and the delimitation of R&D activities is complex. Moreover, the declarations made by multinational firms to the authorities are influenced by the host state incentive and fiscal policies towards business R&D (Sass, 2013).

[7] Patent data does not uncover the total inventive activity of a firm. Some R&D activities do not appear in the patent data because a firm chose not to apply for a patent (Cohen et al., 2000).

of the inventors and the applicant represented more than 10 % of the patent applications: this was essentially the case of some multinational firms whose headquarters are outside Europe and the multinationals which entered patent box regimes (See table 7).

Secondly, determining the country of origin of an invention is also often complex because an invention can result from the cooperation of inventors working in subsidiaries of a multinational located in different countries. The Hungarian inventive capacities may be underestimated if invention made by teams with at least a Hungarian people are systematically assigned to foreign subsidiaries, mainly in countries with low tax regimes on patents. In order to avoid such a misevaluation, we assessed the participation of Hungarian people in multi-subsidiary teams.

We extracted from the AMADEUS database two lists of companies of more than 100 employees of the electronics-electrical-mechanical (division 26 to 28) and automobile (division 29) industries in Hungary:

- The first list contains 237 foreign subsidiaries of multinational firms in Hungary which employ 177,421 people in Hungary.[8]
- The second list contains the Hungarian-owned companies employing more than 100 people: this list contains 75 companies which employ 27,141 people.

Since smaller companies hold an absolute marginal position in the patent attribution, the patent policy of the 312 major electronics-electrical-mechanical-automobile companies is representative of the inventive capacities in Hungary.

We focused our study on the electronics-electrical-mechanical (division 26 to 28) and automobile (division 29) industries since Hungary is among the Visegrad group of countries, the country where these industries play the more important role in the economy. Beginning of the 2010s, one third of the multinational personnel and two fifths of the R&D multinational personnel worked in the electronics-electrical industry.[9] Multinational firms have also massively invested in the Hungarian automobile industry. By the begin of the 2010s, the automobile industry employed one fifth of the multinational personnel and R&D personnel (OECD, 2016).[10] Together electronics and automobile employ roughly two thirds of the R&D personnel working in subsidiaries of multinational firms.

We excluded pharmaceutical multinational firms from our study on patents, although Hungary is the country with the most important pharmaceutical industry in Central and Eastern Europe (Rugraff and Sass, 2015). We took this decision because the pharmaceutical industry has an important characteristic that sets it apart from the other industries: in the pharmaceutical industry a patent virtually equals the product (Lehman, 2003).[11] Integrating

[8] We checked the nationality of the firms by consulting their websites. Numerous companies considered in the AMADEUS database as being Hungarian are in reality foreign-owned. Our list contains therefore much more foreign-owned subsidiaries than was found in the initial database extraction.

[9] This industry represents roughly one quarter of the persons employed in the Hungarian manufacturing industry (OECD, 2016) and of the Hungarian exports (HIPA, 2016).

[10] This industry represents roughly one tenth of the persons employed in the Hungarian manufacturing industry (OECD, 2016) and one fifth of the Hungarian exports (HIPA, 2016).

[11] In other industries it is possible to keep invention a secret until the moment they are marketed. In the pharmaceutical industry, firms have to protect the extensive investment in research and clinical testing

the pharmaceutical industry in our study would create a bias leading to overestimate the patent dynamics of multinational firms in Hungary.

Table 2. Characteristics of the sample

	Foreign subsidiaries	Indigenous firms	Total
Number of firms	237	75	312
Total number of employees	177,421	27,141	204,562
Average number of employees	749	361	656
Standard deviation	1420,9	493,5	1267,7

Source: Authors' calculations based on the AMADEUS database (2016) and website of the companies (2016).

We test the four hypotheses:

Hypothesis 1*: the subsidiaries of multinationals in Hungary do not invest in technologically inventive activities because they have no mandate in terms of basic research and applied development;*

The correlative ***Hypothesis 2*** *is that inventive R&D is a strategic asset which remains located in the home country of the multinational firm;*

To test these hypotheses, we assess, based on the OECD data:

a. The R&D expenditures of the subsidiaries of multinational firms in Hungary compared to West European companies in their home country (in 2009);
b. The R&D expenditures and personnel of subsidiaries of multinational firms in Hungary compared to foreign-owned subsidiaries of multinational firms in Germany (in 2009);

We assess, based on the sample of 237 foreign subsidiaries of multinational firms:

c. The number of patents attributed to the Hungarian subsidiaries of multinational firms in the electronics-electrical-mechanical-automobile industries between 2010 and 2015;
d. The number of patents attributed to the top 20 foreign electronics-electrical-mechanical-automobile investors (in terms of employment) in Hungary compared to the patents they hold in Western Europe;

required before placing it on the market. The culture of medical research emphasizes very early disclosure of inventions usually long before the product can be placed on the market. Patent protection is therefore important compared with other industries because the manufacturing process is often easy to replicate and can be copied with a fraction of the investment of that required for the research and clinical testing.

e. The patents attributed to the West European subsidiaries and headquarters of the 20 multinational firms compared to the patents attributed to their Hungarian subsidiaries (between 2010 and 2015).

We then work on ***Hypothesis 3****: the Hungarian firms' technological inventive capacity – proxied by the number of patent holders among the local manufacturing firms – is too weak to incite the headquarters of multinational firms to transform the mandate in terms of technology given to the local subsidiaries;*

and the correlative ***Hypothesis 4:*** *the transfer of technology through FDI towards indigenous firms remain poor.*

The multinational firms' literature suggests that two determinants play a decisive role in the subsidiaries' orientation towards knowledge creation:

- The operational mandate of the subsidiary within the multinational firms, and especially the mandate in terms of R&D. When a subsidiary has a mandate in terms of R&D, it actively participates to the creation of knowledge and technology that will be circulated in the multinational network. A subsidiary's mandate in term of R&D is positively associated with R&D cooperation with local firms (Gauselmann, 2013).
- The knowledge and technology stock of the local environment. Subsidiaries are incited to engage in cooperative R&D activities when the innovation system in a host country/region is performant. The mandate of the subsidiary can also change over time to take advantage of the technological upgrading of the local environment. The inventive and innovative capabilities of the local firms play a particularly important role in the upgrading of the subsidiaries' mandate (Driffield and Love, 2005).

To test hypothesis 3 and 4 we assess:

f. The number of patents attributed to the 75 major indigenous firms in the electronics-electrical-mechanical-automobile industries between 2010 and 2015.
g. The number of patents attributed to indigenous firms active in upstream and downstream industries of electronics-electrical-mechanical-automobile industries. This indicator is used as a proxy of the inventive capabilities of the indigenous industry.

Indigenous firms were extracted from the AMADEUS database. We selected 312 companies belonging to the industries (NACE, rev. 2) 20, 22 to 30 and 69 to 74 which are potentially providers and clients of the subsidiaries of the multinational firms.

4. Empirics

4.1 R&D activities of subsidiaries of multinational firms in Hungary

The subsidiaries' investment in technologically inventive activities can be assessed by focusing on their R&D performance.

In table 3 we compare the R&D activities of the foreign subsidiaries of multinational firms in Hungary with Western European companies in their home country.[12] Figures clearly shows that the Western European companies are much more R&D oriented in their home country than in their locations in Hungary. In the Western European electronics facilities, domestic firms dedicated 9.2% of their turnover to R&D activities *versus* 0.2% in the Hungarian subsidiaries. Multinational firms organized a strict division of the technological process inside the multinational network: in the electronics industry, the activities in Western Europe are R&D intensive, whereas in the Hungarian subsidiaries, workers are specialized in assembling activities. Hungary is tightly integrated in the European fragmentation of production organized by the multinational firms (Kaminski and Ng, 2005). However, Hungary remains specialized in processes, and mainly in the manufacture of parts, requiring lower costs and purely routine R&D activities.[13] The R&D gap is also wide in the automobile industry. The Western automobile production is more than ten times more R&D intensive than the production in Hungary (Table 3). In Hungary, the subsidiaries are specialized in two main activities: assembling of cars[14] and production and assembling of parts, accessories and engines of motor vehicles.[15] Table 3 demonstrates that the creation of assembly platforms for semi-standardized industrial goods in Hungary was not accompanied by substantial transfer or creation of R&D activities. The gap is the widest in the electronics and automobile industries, the two main sectors of foreign investments in Hungary.

Table 3. R&D activities of subsidiaries of multinational firms in Hungary and West European companies* in their home country, 2009, %

	Intra-mural R&D expenditure as a % of turnover	
	In Hungary	In Western Europe*
Manufacturing	0.4	2.0
Of which:		
Electronics	0.2	9.2
Electrical equipment	0.7	2.0
Machinery and equipment	0.2	2.0
Automobile	0.4	4.6

Note: *Average of seven Western European countries for which statistics was available: Austria, France, Finland, Germany, Italy, Netherlands, Spain.
Source: Authors' calculations based on the OECD statistics database (2016).

[12] In Austria we take the Austrian firms, in Germany the German firms, etc.
[13] Electric appliance for line telephony (HS4, 8517), television receivers (8528), insulated wire/cable (8544), board and panels equipped with switches (8537), electrical appliances for switching (8536) and electrical starting/ignition equipment (8511) represented in 2014 one fifth of Hungary's exports of products (Intracen, 2016).
[14] Exports of cars represented roughly 10% of the Hungarian exports over the 2010s (Intracen, 2016).
[15] Parts, accessories and engines represented also roughly 10% of the Hungarian exports over the 2010s (Intracen, 2016).

In Table 4 we compare the orientation towards R&D of the [foreign-owned] subsidiaries of multinational firms in Hungary and [foreign-owned] subsidiaries of multinational firms in Germany. This analysis is interesting because it compares the R&D behavior of foreign investors in Hungary with the behavior of foreign investors in Germany. The evaluation represents the two sides of the same coin. On the one hand, it is about the strategy regarding technology of the foreign-owned multinational firms: do they invest in inventive activities in the host country? Do the subsidiaries have a mandate in terms of R&D? On the other hand, it is about the location advantage in the host country: are the local inventive capacities sufficient to induce foreign investments in technology?

The results clearly show two different behaviors. Subsidiaries of multinational firms are respectively 6.5 times more R&D-oriented in terms of expenditure and 5.4 times more in terms of personnel in the German manufacturing industry than in the Hungarian industry. The gap is huge between the two countries in the two industries targeted by FDI in Hungary: electronics and automotive. Subsidiaries of multinational firms in Hungary remain poorly active in R&D activities. Because the subsidiaries are used as assembly platforms for semi-standardized goods, R&D investments remain poor. The automobile industry provides a good example of this behavior. Foreign-owned companies that invest in Germany mainly invest in the most dynamic R&D clusters. The R&D personnel, and especially researchers, represent a crucial determinant of their investment decision. Hiring the best researchers and developing their competencies internally is therefore decisive to remain innovative. Subsidiaries of multinational firms have R&D-oriented activities that is only slightly inferior to the German firms' orientation[16]: foreign investors follow asset-seeking strategies in the German automobile industry. In contrast, foreign investors do not consider R&D competencies as being a crucial asset in Hungary: intra-mural R&D expenditures represented only 0.4% of the turnover of the subsidiaries of multinational firms. Subsidiaries secure their workforce by providing higher than average wages, but are still not interested in increasing the technological creativity of their employees.

Table 4 also suggests that in Hungary the local inventive capacities are insufficient to induce foreign investments in technology. Poor R&D investments in 2009 signs the absence of evolution in the mandate of the Hungarian subsidiaries in the multinational firms' value chain. The Hungarian location advantages are still to be found in tangible assets such as moderate labor costs and a fairly skilled workforce but not in more advanced assets such as the endowment in creative engineers and researchers able to produce new knowledge.

Table 4. R&D activities of [foreign-owned] subsidiaries of multinational firms in Hungary and Germany, 2009, %

	Intra-mural R&D expenditure as a % of turnover		R&D personnel as a % of total personnel	
	Hungary	Germany	Hungary	Germany
Manufacturing	0.4	2.6	1.3	7.0

[16] R&D personnel of German automobile firms stood at 10.7% of the personnel in 2010 versus 9.1% for the foreign investors.

Of which:				
Electronics	0.2	10.8	1.8	21.7
Electrical equipment	0.7	2.4	1.2	5.1
Machinery and equipment	0.2	2.9	1.4	5.5
Transport equipment	0.4	6.0	1.6	9.1

Source: Authors' calculations based on the OECD statistics database (2016).

4.2 Inventions and patents in Hungary

The development, testing and adaptation of a product are considered as R&D activities. However, they only marginally contribute to economic growth. In contrast, the firm's investment in basic research and applied development is the central driver of productivity and growth in a modern economy. The emergence of a knowledge-based economy depends therefore from the inventive activity of firms in an economy: researchers act as a the major 'input' for the production of inventive activities and patents can be considered as the most visible 'output' of the inventive activity.

4.2.1 Inventions and patents of the subsidiaries of multinational firms

In table 5 we evaluate the number of patents assigned to the Hungarian subsidiaries of multinational firms in the electronics-electrical-mechanical-automobile industries between 2010 and 2015. The 237 subsidiaries of our sample which employ 177,421 employees hold only 58 patents over the 2010-2015 period, that is to say an average of 10 patents per year. No one subsidiary was attributed more than 20 patents in six years suggesting that the Hungarian subsidiaries have got no mandate in terms of basic research and applied development from their headquarters. Figures of the number and share of researchers – as a percentage of the total employees – working in the subsidiaries of multinational firms confirm that researchers play a minor role in Hungary. Although the number and share of researchers in the subsidiaries of multinational firms strongly increased, they still represent a much lower share of the total employees than in Western Europe: by the end of the 2000s, researchers represented 0.64% of the employees in the manufacturing sector in Hungary *versus* 2% in Germany. In the automotive industry, where 85% of the researchers work in subsidiaries of multinational firms (*versus* 15 % in indigenous firms), the gap also remains wide: 1% and 6.2% of the workers are respectively researchers in Hungary and Germany. The subsidiaries of multinational firms employ far less researchers in Central Europe than in Western Europe.

Our results confirm ***Hypothesis 1***: *the subsidiaries of multinational firms in Hungary do not invest in technologically inventive activities because they have no mandate in terms of basic research and applied development.*

Table 5. Patent holders in the Hungarian electronics-electrical-mechanical-automobile industries, 2010-2015

	Foreign subsidiaries	Indigenous firms	Indigenous firms
Industries	Electronics Electrical Mechanical Automobile	Electronics Electrical Mechanical Automobile	Upstream and downstream industries
NACE Rev. 2	26 to 29 and 70 to 74	26 to 29 and 70 to 74	20, 22 to 30 and 69 to 74
Number of firms	237	75	347
Number of patents 2010-2015	58	2	8
Share of firms with patents	4.2 %	1.3%	4.5%
Number of firms with more than 10 patents	3	0	0
Number of firms with more than 20 patents	0	0	0

Source: Authors' calculations based on the AMADEUS database (2016).

Since the largest multinational firms in the world are also the major patent holders, we focus on the European patenting activity of the 20 major foreign investors in Hungary in the electronics-electrical-mechanical-automotive industries (Table 6). These 20 companies represent two thirds of the people employed by the foreign investors and two thirds of the patents assigned to foreign investors in Hungary in the four industries. Between 2010 and 2015, only 31 patents were assigned to four out of 26 Hungarian subsidiaries in comparison to a total of 64,643 patents assigned to the 20 multinational firms in Western Europe.

Multinational firms coming from Western Europe

Out of the eight European multinational firms, only one, Audi, was assigned ten patents in Hungary.[17] Hungary has attracted industries whose inventive activities remain located in the home country of the multinational firms in Western Europe. Although the literature detects

[17] Three Hungarian people and five teams composed of Hungarian and German people are considered as the inventors. One inventor works in an Austrian subsidiary of Audi and in one case the location of the inventor could not be defined.

an acceleration of the internationalization of R&D activities (Le Bas and Sierra, 2002; Song et al., 2011), this is clearly not the case in the electronics-electrical-mechanical-automotive industries. Almost nine tenths of the patents in our sample are attributed to the headquarters or to one subsidiary in the home country of the multinational firms in Western Europe. The eight European multinational firms, and especially the five German companies, continue to concentrate their inventive activities in a small number of R&D subsidiaries in the home country and to a lesser extent in other Western European countries. Hungarian engineers and researchers do neither participate in Hungary to the multinationals' knowledge creation, nor participate to trans-European co-creation of technology that mainly links together teams of people working in the West European subsidiaries of the multinational firms.

Figures confirms ***Hypothesis 2***: *inventive R&D remains located in the home country of the multinational firms.* Headquarters control the production of new knowledge and transfer the knowledge in the form of production-related innovation to the Hungarian subsidiaries. The Hungarian subsidiaries passively receive the technology and do not participate in the co-production of new knowledge. There is still a strict division of the technological process inside the multinational network and only little technological collaboration between Hungarian and Western subsidiaries. Given that there is no need for inventive people in Hungary, the multinational firms have no interest in the promotion of an ecosystem and an education system which would foster highly qualified people. Researchers and engineers are mainly specialized in routine and production-supportive R&D activities.

Table 6. Patents policy in Europe of the 20 main foreign investors in Hungary in the electronics-electronical-mechanical-automotive industries, 2015

Nationality	Company	Number of employees worldwide	Number of entities with patents in Europe (Hungary excluded)	Number of patents in Europe, 2010-2015	Share of patents of the main subsidiary or Headquarters, %	Number of affiliates in Hungary	Number of employees in Hungary	Number of patents assigned to Hungarian subsidiaries [number of patents with Hungarian people]	Major applicant for patents in Europe*
DE	Audi	84,000	1	5012	100	1	12,005	10 [8]	DE
DE	Bosch	375,000	17	30,424	98	5	10,419	0	DE
USA	GE	333,000	4	76	86	1	9114	1 [1]	DE
Singapore	Flextronics	141,000	1	13	100	1	5939	17 [0]	DE
Japan	Denso	151,000	4	77	52	1	4035	0	DE
USA	Jabil Circuit	100,000	0	0	/	2	3997	0	/
DE	Mercedes	284,000	1	13,371	100	1	3817	0	DE
USA	Delphi	173,000	8	383	74	2	3625	0	Lux
USA	Lear	122,000	2	33	94	1	3585	0	DE
DE	Continental	208,000	8	2652	65	1	3262	0	DE
SE	Electrolux	58,000	11	1358	76	1	3113	0	BE
Japan	Suzuki	57,000	0	0	/	1	3060	0	/

DE	Schaeffler	84,000	1	8885	100	1	2860	0	DE
Canada	Linamar	23,000	1	2	100	1	2404	0	DE
DK	Grundfos	19,000	4	153	82	1	2294	0	DK
SE	Autoliv	64,000	1	1772	100	1	2207	0	SE
USA	Harman-B.	27,000	1	432	100	1	1811	1 [0]	DE
Japan	EPCOS	92,000	0	0	/	1	1744	0	/
Korea	Hanon	15,500	0	0	/	1	1637	0	/
Japan	Motherson	80,000	0	0	/	1	1707	0	/
Total		2,490,500	65	64,643		26	82,635	29 [9]	
Average		214,525	3,3	3222,2	88.5 %	1,3	4131,8	1,4 [0,4]	
SD		103,706	4,5	7297,9	15.5	0,9	2974,5	4,3	
Top 20/ total foreign						20.3%	67 %	63.3%	

Source: Authors' calculations based on the AMADEUS database (2016) and the webpages (annual reports) of the companies (2016).

Multinational firms coming from Asia and North-America

The 12 major Asian and North-American electronics-electrical-mechanical-automotive investors in Hungary follow two main strategies (Table 6):

- A first group composed of five multinational firms, hold no patent in Europe. The European subsidiaries of these multinational firms have no mandate in terms of knowledge creation.

- Subsidiaries of the second group of seven companies hold 1034 patents in Europe, of which 21 (2 %) were assigned to Hungarian subsidiaries.

Yet working on the location of patents (assignments) may under-evaluate the real Hungarian inventive contribution because:

a) Some invention made in Hungary may have been assigned to a non-Hungarian subsidiary. The American multinational firm Delphi, for example, organizes a geographical separation between the location of the patents (Luxembourg) and the place where the inventors made their invention.

b) Hungarian inventors may participate to multi-subsidiaries teams of researchers although the patent was not located in Hungary.

We focus therefore on the location of inventors of 882 patents assigned to the European subsidiaries of six of the major Asian and North-American electronics-electrical-mechanical-automotive investors in Hungary.[18] Table 7 clearly demonstrates that there is no under-evaluation of the participation of Hungarian people in the invention of the multinational firms. The Hungarian people do not participate to multi-subsidiary teams at the origin of new inventions. Some multinational firms organize an important separation of the location of applicants and the location of the inventor(s): however, Hungarian people are never the

[18] It was impossible to determine the location of inventors for 152 patents. We excluded the Canadian company Linamar with only two patents.

inventors - or members of an inventor team - of an invention assigned to subsidiaries located abroad. 7 % of the patents results from the invention of people working in several subsidiaries of multinational firms. However, no researcher working in Hungary has been associated to these collaborations. The number of patents assigned to Hungarian subsidiaries is even higher than the inventions made in the country. The Hungarian subsidiary of the Singaporean Flextronics is the major company's patent holder in Europe. However, the patents assigned to the Hungarian subsidiary all result from inventions done by inventors who do not work in Hungary. Out of a total of 882 patents, only one has an inventor located in Hungary.

Table 7. Location of patents and investors of the European subsidiaries of six of the major Asian and North-American multinational firms in Hungary, 2010-2015

	Location of patents		Location of inventors			Patents with separation applicant and inventor
	Europe	Of which: Hungary	Multi-subsidiary team of inventors	Multi-subsidiary team with Hungarian inventor(s)	Inventor(s) in Hungary	
Delphi	276	0	41	0	0	92.3 %
Harman Becker	417	1	15	0	0	2.6 %
GE	55	1	3	0	1	11.1 %
Flextronics	30	17	2	0	0	56.6 %
Denso	72	0	7	0	0	0
Lear	32	0	1	0	0	0
TOTAL	882	19	69	0	1	/

Source: Authors' calculations based on the AMADEUS database (2016).

Finally, researchers and engineers working in Hungarian subsidiaries of multinational firms are specialized in production-supportive development activities but not in basic research and applied development. Given the small number of researchers and engineers employed in the Hungarian plants of multinationals and their orientation towards production-supportive developments, the Hungarian subsidiaries do not produce new knowledge.

4.2.2 *Inventive capacities of the indigenous firms*

In the 1990s, the number of researchers active in the manufacturing industry has massively decreased in Hungary as well as in the other Central and Eastern European countries. Since the beginning of the 2000s and the massive implication of FDI in Hungary an inversion of the trend has taken place: researchers active in the manufacturing industry have progressively increased. In 2012, the Hungarian manufacturing industry employed 10,893 R&D personnel of which 6814 (62.5%) were researchers (OECD, 2016). Despite this increase, the technological inventiveness of the Hungarian companies remains in the mid-2010

dramatically poor. In our sample which contains the 75 major electronics-electrical-mechanical-automotive indigenous firms only two companies were assigned patents between 2010 and 2015 (Table 5). In the upstream and downstream industries of the electronics-electrical-mechanical-automotive industries – 347 companies in our sample – only 8 companies were assigned patents (Table 5). No Hungarian company, out of a sample of the 422 largest Hungarian companies, were assigned annually more than two patents over a period of six years. Videoton (8400 employees), Jasz Plasztik (4000) and Raba (1700) are the three largest Hungarian-owned manufacturing companies in the electronics-electronical-mechanical-automotive industries. The three companies are specialized in the production components and parts for the subsidiaries of multinational firms.[19] The three companies are not technology-creative companies. During the last six years they were attributed no patent. They did not locate activities in Western Europe, but in other Eastern European countries where labor costs are lower than in Hungary.[20]

Hypothesis 3 is confirmed: *the Hungarian firms' inventiveness is too weak to incite the headquarters of multinational firms to transform the mandate in terms of technology given to their local subsidiaries.*

5. Conclusion

Institutional processes shape firm's behavior: the legacy of communism and the priority in terms of institution building in the transition period created an institutional framework unfavorable to the emergence of technology-inventive companies in Hungary. In the communist institutional settings, the enterprises were dissuaded from taking risks and being inventive (Kornai, 1980). In the transition period, the strategic priority of the firms was to survive, and therefore being inventive was totally out of reach of a majority of them (Ickes and Ryterman, 1993). Communism has destructed the private firm as an institution and the transition period has been characterized by the transfer of the largest and best companies – the companies with the highest probability to be inventive in the future – to the foreign investors.

The quasi-absence in Hungary of medium indigenous firms – the equivalent to the German *Mittelstand* – and large indigenous multinational firms, results form a co-evolutionary process: it was caused by the Hungarian political choice and reinforced by the strategy of the multinational firms. The multinational firms collectively and intentionally shape the institutional structures. The quasi-absence in Central Europe of family-owned groups results from institutional processes, but also from crowding-out of local rivals by the multinational firms in the 1990s and the dominant role played by the multinational firms in the structuration of economic activities since the 2000s (Hunya, 2000). In the electronics-

[19] Videoton is a contract manufacturing company. Jasz Plasztik produces plastic parts for the automobile industry. Raba produce axles, automotive components and vehicles. The automotive parts and goods which represent three quarter of the sale revenue are mainly sold to the subsidiaries of multinational firms in Hungary.

[20] Videoton has nine plants in Hungary, one in Bulgaria and one in the Ukraine. Jasz Plasztik operates five plants in Hungary, one in Slovakia and one in Romania.

electronical-mechanical-automotive industries, the indigenous firms, even the largest one, have been forced either to specialized in activities not occupied by the multinational firms or to become their suppliers. The subsidiaries' specialization in assembling activities locks indigenous suppliers in price-driven subcontracting. Given the peripheral position in knowledge creation of the Hungarian subsidiaries, they are neither able to engage in technology collaborations with indigenous suppliers nor interested in innovative supplies that would increase the production costs. Moreover, the multinational firms' orientation towards price-driven subcontracting, incite local entrepreneurs to enter into activities generating immediate profit and deter them from engaging into riskier technology-oriented activities. The presence of local firms with strong technology capabilities could incite subsidiaries to develop their collaboration in order to benefit of 'reverse spillover'. This mechanism could upgrade the technological position of the subsidiary in the multinational value chain and contribute to reduce the hierarchical supervision and increase their autonomy. Yet the communist legacy in terms of technological weakness and the absence of a FDI policy guided towards the building of more advanced technological competencies did not foster the cooperative behavior of the subsidiaries of the multinational firms.

Finally, the absence of mandate of the subsidiaries of multinational firms in terms of inventive activities combined with the poor inventive potential of the indigenous companies explain that, in Hungary the *transfer of technology through FDI towards indigenous firms remain very limited* (***Hypothesis 4***). In Hungary asset-exploiting R&D investments prevail over asset-seeking R&D investments. Researchers and engineers are mainly specialized in routine and production-supportive R&D activities.

References

Amable, B. (2000) Institutional complementarity and diversity of social systems of innovation and production. *Review of International Political Economy*, *7*(4), 645-687.

Aoki, M. (1988) *Information, incentives and bargaining in the Japanese economy: a microtheory of the Japanese Economy*. Cambridge University Press.

Berger, S., Kurz, C., Sturgeon, T., Voskamp, U., and Wittke, V. (2001) Globalization, Production Networks, and National Models of Capitalism-On the Possibilities of New Productive Systems and Institutional Diversity in an Enlarging Europe. *SOFI-Mitteilungen,* 29, 59-72.

Bevan, A. A. and Estrin, S. (2004) The determinants of foreign direct investment into European transition economies. *Journal of Comparative Economics*, 32(4), 775-787.

Bohle, D. and Greskovits, B. (2007) Neoliberalism, embedded neoliberalism and neocorporatism: Towards transnational capitalism in Central-Eastern Europe. *West European Politics*, 30(3), 443-466.

Carney, M., Gedajlovic, E., and Yang, X. (2009) Varieties of Asian capitalism: Toward an institutional theory of Asian enterprise. *Asia Pacific Journal of Management*, 26(3), 361-380.

Cohen, W. M., Nelson, R. R., and Walsh, J. P. (2000) *Protecting their intellectual assets: Appropriability conditions and why US manufacturing firms patent (or not)*, No. w7552. National Bureau of Economic Research.

Deloitte (2015) Available online: http://www2.deloitte.com/global/en/pages/about-deloitte/articles/central-europe-top500.html

Driffield, N. and Love, J. H. (2003) Foreign direct investment, technology sourcing and reverse spillovers. *The Manchester School*, 71(6), 659-672.

Eyal, G., Szelenyi, I., and Townsley, E. R. (1998) *Making capitalism without capitalists: Class formation and elite struggles in post-communist Central Europe*. Verso.

Freeman, C. and Soete, L. (2007) Science, technology and innovation indicators: the twenty-first century challenges. *Science, Technology and Innovation Indicators in a Changing World Responding to Policy Needs: Responding to Policy Needs*, 271.

Gauselmann, A. (2013) *MNEs and Regional R&D Co-operation: Evidence from Post-Transition Economies*. GRINCOH Working paper 12-2013.

Gereffi, G., Humphrey, J., and Sturgeon, T. (2005) The governance of global value chains. *Review of international political economy*, 12(1), 78-104.

Hall, P. A. and Soskice, D. (2001) *Varieties of capitalism*. *The institutional foundations of comparative advantage*. Oxford University Press, New York.

HIPA (Hungarian Investment Promotion Agency) (2016), Available online: https://hipa.hu/main#why-hungary

Hunya, G. (Ed.). (2000) *Integration through foreign direct investment: making central European industries competitive*. Edward Elgar Publishing.

Ickes, B. W. and Ryterman, R. (1993) *From Entreprise to Firm: Notes for a Theory of the Enterprise in Transition*, No. 10-93-7.

International Trade Center (Intracen) (2016) International trade statistics, Available online: http://www.trademap.org/tradestat/Product_SelCountry_TS.aspx

Kaminski, B. and Ng, F. (2005) Production disintegration and integration of Central Europe into global markets. *International Review of Economics & Finance*, 14(3), 377-390.

Karkinsky, T. and Riedel, N. (2012) Corporate taxation and the choice of patent location within multinational firms. *Journal of International Economics*, 88(1), 176-185.

Khanna, T. and Yafeh, Y. (2007) Business groups in emerging markets: Paragons or parasites? *Journal of Economic literature*, 45(2), 331-372.

Kornai, J. (1980) *Economics of shortage* (Vol. 2). North Holland.

Lane, D. S. and Myant, M. R. (Eds.). (2007) *Varieties of capitalism in post-communist countries* (pp. 13-39). Basingstoke: Palgrave Macmillan.

Le Bas, C. and Sierra, C. (2002) Location versus home country advantages' in R&D activities: some further results on multinationals' locational strategies. *Research policy*, 31(4), 589-609.

Lehman, B. (2003) The pharmaceutical industry and the patent system. Wake Forest University. Available online: http://users.wfu.edu/mcfallta/DIR0/pharma_patents.pdf

Meyer, K. E. (1995) Foreign direct investment in the early years of economic transition: a survey. *Economics of Transition*, 3(3), 301-320.

Nölke, A. and Vliegenthart, A. (2009) Enlarging the varieties of capitalism: The emergence of dependent market economies in East Central Europe, *World Politics,* 61(4), 670-702.

OECD (2004) Employment Outlook, OECD Publications, Paris.

OECD Statistics Database (2016) Available online: http://stats.oecd.org/Index.aspx?lang=en&SubSessionId=d750b607-6257-45fe-805a-f9f142538bc1&themetreeid=-200

Roland, G. (2002) The political economy of transition. *The Journal of Economic Perspectives*, 16(1), 29-50.

Rugraff, E. (2006) Firmes multinationales et relations industrielles en Europe centrale : une approche institutionnaliste. *Relations industrielles/Industrial Relations,* 61(3), 437-464.

Rugraff, E. (2008) Are the FDI policies of the Central European countries efficient? *Post-Communist Economies*, 20(3), 303-316.

Rugraff, E. and Sass, M. (2015) *Indigenous technological development through subcontracting linkages from multinationals: evidence from the Hungarian pharmaceutical and biopharmaceutical industry*. Research seminar „Multinationals, local firms and innovation in post-transition and transition economies", The EADI Working Group on "Transnational Corporations and Development" and the FDI-group of the Centre for Economic and Regional Studies of the Hungarian Academy of Sciences, 14 December, Budapest.

Sass, M. (2013) *Case study evidence of the extent and nature of foreign subsidiaries' R&D and innovation capability in Hungary*. European Union's Seventh Framework Programme (FP7/2007-2013).

Schneider, B. R. (2009) Hierarchical market economies and varieties of capitalism in Latin America. *Journal of Latin American Studies*, 41(03), 553-575.

Song, J., Asakawa, K., and Chu, Y. (2011) What determines knowledge sourcing from host locations of overseas R&D operations? A study of global R&D activities of Japanese multinationals. *Research Policy*, 40(3), 380-390.

UNCTAD (2005) *World Investment Report, Transnational corporations and the internationalization of R&D*. United Nations, New York and Geneva.

Witt, M. A. and Redding, G. (2013) Asian business systems: institutional comparison, clusters and implications for varieties of capitalism and business systems theory. *Socio-Economic Review*, 11(2), 265-300.