

The Automotive Industry in Central and Eastern Europe

– Engine of Growth or Free Rider?

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Abstract

The impact of FDI onto host countries economies is heavily debated, particularly for transition economies. However, sectoral research is scarce. Building on Aristotelous and Fountas (1996) and using data from automobile manufacturers associations (OICA and ACEA), we analyze the impact of automotive FDI on exports and GDP growth for five transition economies over the 1995-2006 period. We find that automotive FDI triggered economic growth in several CEE countries, though at varying degrees.

Key Words: Foreign Direct Investment, Automotive Industry, CEE, Panel Data Analysis

JEL-Codes: E22, F21, F23, L62

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Introduction

In the current global economic turmoil, two sectors stick out: the financial services industry and the automotive industry. In the Central and Eastern European transition economies (CEE), large-scale FDI in these two sectors was long heralded as a backbone for economic transformation, though current market volatility drew also raised concerns about concentration risk that goes along with these massive sectoral FDI flows. While the economic impact of FDI at large has received a lot of attention (e.g. Boudier-Bensebaa, 2008; Dimelis and Louri, 2004; Mencinger, 2003); Meyer, 2000), research on sectoral aspects is rather scarce (see e.g. Roessl and Haiss, 2008, on the banking sector). With regard to the automotive industry, large-scale FDI inflows into CEE are well documented by both scholarly research (see e.g. Galgóczi and Tóth, 2000; Lung, 2004; Pavlinek, 2002; Resch and Haiss, 2007; Rhys, 2004; MacNeill and Chanaron, 2005; Vagac, 2000) and consultants, banks and interest groups (e.g. Deloitte, 2007; Fuss et al, 2007; IKB, 2004; UCI, 2007; Lefilleur and Lepape, 2004), but its economic impact has not yet been empirically investigated.

Was the large-scale FDI into the New EU Member States (NMS) and Accession Countries (AC) an engine for growth in the region, or did foreign entrants just take advantage of favorable conditions? In the following discuss the transition process of the automotive industry in eight selected NMS and AC, namely Poland, the Czech Republic, Slovakia, Hungary, Slovenia, Serbia, Romania and Turkey, to investigate the role of the automotive sector in the industrial reorganization of these countries. Over the 1995-2006 period, we apply linear models and panel data approaches to analyze the impact of automotive FDI on exports and GDP growth for five New EU Member States from CEE. We use data from selected statistical institutes (the OECD, Eurostat, OICA^b, WIFO and WIIW) and background material from scholarly reviews and industry sources (e.g. Ernst & Young, KPMG, PWC, UCI and

^b The International Organization of Motor Vehicle Manufacturers

Automotive Associations, the OICA and ACEA^c). We find that automotive FDI was indeed a motor for the respective CEE economies, though at varying degrees. Our contribution confirms the impact of FDI on host economies on a sectoral level, thus supporting further efforts in this area. This finding is important for shaping industrial strategies and entry strategies in transition and emerging economies at large.

The Automotive Industry in CEE

Several of the NMS are now major partners within the integrated production patterns of major Western European and also Asian original equipment manufacturers (OEMs) and suppliers. They formed “autoclusters”, i.e. numerous plants and settlements of suppliers, manufacturing industry and their respective OEM producer are located in certain regions. The main CEE autoclusters are shown in figure 1 for the CEE (including Russia, Ukraine, and Bulgaria). After the opening of a new plant by OEMs, suppliers followed to settle their industries near the cluster, better than operating from far away and having high logistic costs. To give an overview of the global manufacturers of vehicles, figure 2 shows the most important brands producing in the CEE region. The suppliers are settled around the main OEM locations, though not explicitly depicted in the chart. Figure 3 shows the development of GDP per capita of the different countries.

Xxx Insert Figure 1 (GDP per capita) about here xxx

XX insert figure 2 (automotive clusters) about here XX

XXX insert figure 3 (OEM presence) about here XXX

^c European Automobile Manufacturers Association

Figure 4 depicts the growth in automotive FDI over the 1997 to 2006 period, which was particularly strong since 2002 but has now come to a halt due to the financial market turmoil. Figure five shows the considerable share of automotive FDI in several CEE countries, amounting to 15 to 30% of the stock in manufacturing FDI.

Xxx Insert Figure 4 (Automotive FDI inward stock) about here xxx

XXX insert Figure 5 (Share of automotive FDI) about here XXX

The opening of the transition economies provided a chance for establishing regionally close but cheaper automotive production locations for re-export to richer, mature economies, while at the same time ensuring local brand presence once these economies economic catch-up also turns them into a sales location (Heyman, 2004). Privatisations of original equipment manufacturers (OEM) like Skoda served as role models across CEE (Resch and Haiss, 2007). Besides clothing and electronics, the automotive sector has been among the few branches where the CEE countries have become producers on a global level (Radosevic and Rozeik 2005: 4). The Czech Republic, Poland, Slovakia and with some distance Romania, Hungary and Slovenia have the largest car production capacities across the New EU Member States now. Global players like VW, PSA (Renault, Peugeot), General Motors, Fiat and Daewoo are the most important companies that have discovered the New Member States (Radosevic and Rozeik 2005: 25).

The *Czech Republic* has become a leading producer in the region. As a production and supplier location, it is close to European original equipment manufacturers (OEM) in Germany and France and has certain advantages as regards facilities, technical expertise, manufacturing history and low costs (Radosevic and Rozeik 2005: 14). Given the strong

cross-border (home-host) integration of the OEMs and the strong dependence of the respective host economies on the automotive sector, cross-border solutions are necessary to overcome the current market turmoil. While finding qualified employees was the CEE automotive companies biggest issue during the high-growth-period up to mid 2008, retaining them is the current issue.

With its local manufacturer, Skoda (part of the Volkswagen Group), the *Czech Republic* has a unique position, and has developed an international brand with high quality (see Ernst & Young in the following). Other manufacturers, like PSA^d, Toyota, and Hyundai, recently invested in the country, building assembly plants. Most of the produced cars were exported but with growing GDP per capita, local demand has risen too. Beside these big plants, a number of mid-sized component suppliers and tool manufacturers form a well established network. In the Czech Republic, the infrastructure level is high and well developed and the large base of suppliers attracts investment in the sector.

Slovakia similarly has turned into one of the main hubs in the CEE region: VW was the first, followed by PSA and KIA, to build assembly plants. This highly concentrated automotive industry gives the country a unique position and also a strong dependency on car exports. Concentrated in only two regional auto clusters, hiring and retaining skilled labor was becoming increasingly challenging. The environment of Slovakia is favorable and the Slovak government attracts investors with good solutions and flat tax guaranteeing the country's position in the automotive market for years to come.

The *Hungarian market* is dominated by Suzuki, who owns a large plant, and also Audi and GM^e are well established, with large centers for producing engines and power trains. As a member of the EU but not a member of the monetary Euro System the strong devaluation of

^d Peugeot Société Anonyme

^e General Motors

the Hungarian Forint against the Euro currently proves a major issue for investors across the sectors. International support, the countries stability-oriented institutions and good infrastructure, and investors long-term oriented strategies are set to provide a basis to overcome the current turmoil.

In *Poland*, significant vehicle manufacturing by Fiat, Opel and VW in the 1990's, and nowadays Toyota and MAN, gave this country a strong position on the automotive market. Supported by the EU, FDI are very high and suppliers are migrating to the plants. Infrastructure in this country is progressing slowly, roads are in rather bad conditions. Local demand will be high in the next years. With special offers for FDI incentives, the Polish government supports development of regions which were not growing as fast.

With Dacia producing under license from Renault, *Romania* produces low cost cars for the European continent. Bureaucracy is difficult and infrastructure is at a very low level. Labor costs are low and qualifications are high. With such a favorable geographical position this large economy will raise future FDI and can expect a strong position in the automotive industry.

While automotive FDI was strongly privatization-driven, i.e. went mainly into the larger CEE countries, smaller countries could also attract automotive FDI, some trying to lure in suppliers (e.g. Bulgaria). *Slovenia*, as one of the smallest countries, hosts a well established automotive industry driven by Renault and other suppliers producing components for the EU market. Investments slowed down due to high wage levels. The well developed economy, though with socialist traditions, may create challenges for foreign investors. Infrastructures similar to Western Europe are fully developed, and the good relations to former Yugoslav neighbors constitute some of the country's attractiveness. For the *Serbian economy*, the automotive components industry is one of the cornerstones of the economy. With cooperation from

Western Europe Serbia could expand its capacities in the future. Investments are still low but with the approach to the EU, change is coming.

Based on the free trade agreement with the EU, the traditional automotive industry of *Turkey* has shown significant development in the last years, specifically with regard to buses and coaches. Their remarkable focus on large commercial vehicle production plants operated by international manufacturers like Ford, Fiat, PSA and Honda offers significant growth. With 70 million inhabitants, the low density of the local demand market is very attractive too.

The respective countries strengths and weaknesses are also depicted in their automotive production patterns. Table 1 shows the production units per employee for automotive production over the 1993 to 2005 period. This indicator shows that relative to the countries workforce, the automotive sector is of highest relevance in Slovenia, Slovakia, Poland and the Czech Republic, with Romania gaining ground more recently with the expansion of the Dacia plant.

Xxx Insert Table 1 (automotive production units per employee) about here xxx

Looking at production units per employee is interesting for tracking the development of the automotive industry. It is common that industry becomes more and more automated, as many functions can be completed better and more efficient by machines. Over the 1993 to 2005 period, units produced per employee, rose in all countries covered, providing evidence of the development of the automotive industry. This trend toward automation is growing as fast as the development of new vehicles.

For the overall part of our study we will now briefly show the share of the automotive industry (respectively transport equipment) in the respective countries' total exports. Not all data was available from the beginning, but it is surprising how high the share for various

countries is (see figure 6). While in the case of the Czech Republic and Hungary, automotive exports amount to about 18% of total exports, the rise in FDI-based production capacities in Slovakia led to a rise to nearly 30%. Turkey also shows a strong rise over the years to nearly 15%, which, however, also goes hand in hand with the decline of its hitherto important textile exports. The rise in exports clearly is evidence for the obvious productivity of the respective economies. The rising exports clearly are an indication that automotive FDI could be seen as engine of aggregate economic growth in the respective countries. The high share of automotive exports is also explainable through the high levels that this industry is involved. The value of a vehicle, trailer or semi-trailer has a higher part in exports than other consumer goods. The Production and Assembly Units of our selected CEE countries were displayed in figure 7.

Xxx Insert Figure 6 (share of automotive exports) about here xxx

Xxx Insert Figure 7 (production and assembly rates) about here xxx

Theoretical Framework and Literature Review

Various studies investigate the link between FDI and economic development (see table 2 for a selected overview), with only a few paying attention to sectoral issues. Inward FDI effects for the car industry were analyzed by Chung, Mitchell and Yeung (2003). They investigated two channels of FDI influence: technology transfer and competitive pressure. The Chung et al. research deals with the American situation in the 1980's when Japanese auto manufacturer placed their facilities in the U.S. They focus on Americas' component industry. They found no evidence concerning direct technology transfer, but the results indicated that competitive pressure overshadowed any direct technology transfer during the early stages of FDI.

Competitive pressure was the main reason for productivity growth in the supply sector that occurred following inward FDI (Chung et al, 2003: 215).

Xxx insert table 2 (selected studies on FDI productivity) about here xxX

In a related study, Buckley et al (2007) analyzed the impact of FDI on the productivity of China's Automotive Industry. Key results were that inward FDI plays a positive role in increasing industry productivity, implying that the government should continue to encourage inward investment. Results also suggest that efforts to increase capital intensity and average firm size in the industry will also improve labor productivity (Buckley et al, 2007).

Kornecki and Rhoades (2007) analyzed how FDI facilitates the globalization process and stimulates economic growth in CEE. They review the experience of CEE countries in integrating into the global market and suggests a link between FDI stock and economic growth. Their results show that high foreign capital inflows and very high percentage share of FDI stock in GDP indicate that foreign capital plays a vital role in CEE economies and has become an important indicator of the advancing globalization process in CEE countries.

Model, Data and Methodology

The available data allows us to estimate the effects on the automotive industry of CEE. Due to poor data availability we focus on five countries, Czech Republic, Poland, Hungary, Slovak Republic and Slovenia, 60 observations. We also ran correlations with our different variables, shown in table 3. Following a number of previous studies (Buckley et al 2007; Chung, Mitchell and Yeung, 2003; Korneck and Rhoades, 2007) we estimate a model of the production function with GDP per capita as the dependent variable. The model of the productivity function is given in equation (1) below:

$$(1) \text{ GDP_CAP} = f(\text{FDI_34}, \text{L_TOTAL}, \text{L_34}, \text{EDUC}, \text{CS_TOTAL}, \text{PROD_CAP})$$

Our Variables we use for calculating are: GDP per Capita, automotive FDI (Nace Code 34; termed FDI_34), total employment (L_Total), employment by the automotive industry (Nace Code 34; L_34), capital stock (CS_Total), educational attainment (Educ) and production rates of the automotive industry (Prod per Capita). In table 3 the results of the correlation test of the different variables and sources of them were mentioned in detail.

Xxx Insert Table 3 (Results of correlation test) about here xxX

All of the monetary variables are measured at 1995 constant prices. To test the model for the automotive industry in CEE, a panel data set is employed. The time period considered is 12 years from 1995 to 2006. Data came from different sources (ACEA, OICA, WIIW). The difference to existing studies is that we focus on the automotive sector and thus used inward FDI of the automotive industry and not just overall inward FDI. In table 4 the different variables were explained in detail.

Xxx insert table 4 (description of variables) about here xxX

The following procedures were applied. First we input the data into Excel and analyzed it with Stata^f. Because of only few years of data available (2000-2006) we considered a panel data analysis with only five countries that achieved our criteria's. In Excel, our absolute values had to be calculated to consistent values. Therefore were calculated values per capita and monetary unit to USD to discard external effects. After having the variables on a comparable level, they were logarithmized and copied into Stata Program. In order to measure directly the impact of the explanatory variables on the dependant variable in terms of elasticity, the variables in the equation (1) can be written in logarithmic form:

^f Data Analysis and Statistical Software

$$(2) \text{ GDP_CAP}_t = \beta_1 \text{ LN_CS_TOTAL}_t + \beta_2 \text{ LN_FDI_34}_t + \beta_3 \text{ LN_L_TOTAL}_t + \beta_4 \text{ LN_L_34}_t + \beta_5 \text{ LN_EDUC}_t + \beta_6 \text{ LN_PROD_CAP}_t + \varepsilon_t$$

Where LN indicates logged values; t denotes the time, respectively; ε_t is a composite term including both the intercept and the stochastic error term. The coefficients $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$ indicate the percent change in GDP associated with a given percent change in FDI_34, L_TOTAL, L_34, EDUC, CS_TOTAL and PROD_CAP respectively. There are three statistical models used to estimate panel data sets; a pooled ordinary least squares model (POLS), a fixed effects model (FES), and a random effects model (RES). Table 3 shows the correlations of the different variables.

To specify which of the three tests will be useful for our data sets, we made the Hausman's specification test (see table 5), which says us if RES or FES is better for our results. Indeed the result is positive for FES Analysis (we decline the null hypothesis).

XXX insert table 5 (Hausman specification test) about here XXXX

XXX insert table 6 (Results of Panel Data Analysis) about here XXXX

Empirical Results

The empirical results obtained from POLS, FES and RES are summarized in table 6. Due to the Hausman's test we will focus on the results of the FES estimations. The results of the FES model show that automotive FDI (FDI_34), total employment (L_TOTAL), automotive employment (L_34), educational attainment (EDUC), capital stock (CS_TOTAL) and production rates of the automotive industry (PROD_CAP) are positive as expected and statistically significant at different levels, while no variable is negative. The coefficient for CS_TOTAL is positive and significant at the 1percent level, indicating that Capital Stock positively affects output of CEE countries. The magnitude of CS_TOTAL reveals that one

percent increase in capital stock will raise output by 0,7 percent. The FDI_34 variable is positive and statistically significant at 1 percent level. This result implies that foreign direct investment in the automotive industry does affect output of the selected CEE countries positively. The magnitude of FDI_34 is not high but indicates that one percent of automotive industry foreign direct investment increase would result in 0,1 percent increase in output. The coefficient of the Education variable, EDUC again is positive and statistically significant at the 1 percent level, which suggests that EDUC lagged by one year positively affects output in CEE. The magnitude of EDUC is 4,76 which means that by an increase of 1 percent on GDP, EDUC is raising about 4,8 %. The results suggest also that employment in total, L_TOTAL, and also only for automotive industry, L_34, affect positively and statistically significant at 1 percent level the output of CEE. The values are not high, magnitude for L_TOTAL implies, with a percent increase, raising Output by 0,27 percent and for L_34, raising Output by 0,11 percent. The last variable, PROD_CAP is the only being statistically significant by 5 percent level. The magnitude of PROD_CAP, by raising 1 percent, raises Output only by 0.36 percent.

Surprisingly however, none of our variables were found to be negative, and they are nearly all statistically significant at 1 percent. The result implies that they are all important determinants of the productivity function. It is also important to look at the economic cycle of CEE countries during the period under investigation here, which is characterized by a rapid economic development and catch-up. Our studies only a rather short period (1995 to 2006), so a lot of factors could influence further developments. The results are in accord with previous papers which suggest FDI has a positive impact on productivity of the host country (see **tabl. 6**) so they should continue to promote FDI in automotive industry.

Limitations

To make empirical cast-iron studies, long term data would be advantageous and the measured values would have to have equal methods of measurement, if possible from one source. In our case, data for the CEE countries is really difficult to find. Because of its transitions in the 1990s, data before 1990 is not available and also not comparable to Western style. Including early years of transition (from around 1990 to 1995) is also not useful because of problems concerning reconstruction of the economy, transition shocks, and data consistency. With progressing accession to the European Union and adaptation of international statistical standards, data consistency and reliability comes closer to the level of mature market economies. In our study all data is taken, if possible, from 1995 to 2006. Due to data availability, we could not include all New EU Member States and Accession Countries, limiting our empirical study to those five NMS where the automotive industry plays a key role: the Czech Republic, Poland, Hungary, Slovakia and Slovenia. For the production rates OICA provides good data but we could not differentiate between production and assembly (i.e. these two values were added up).

Sectoral FDI data for the automotive industry were very difficult to find, for a few countries the Austrian Institute of Economic Research (WIFO, <http://www.wifo.at>) gives useful data but measurement methods were different, either under NACE section “34, motor vehicles, trailers and semi-trailers” or under section “transport equipment”. The difference between them is not found, “34, Motor vehicles, trailers and semi trailers” should be part of transport equipment. Also here the data is different for the volumes, either from 1997-2005, or 2003-2005. On national Statistics Homepages, the data is also not available and after multiple requests they could not help us out.

For the Employees working for automotive industry it is the same problem as for the FDI data. Measurement methods differ, volumes are poor and incomplete. Our additional data from the OECD's structural analysis database (OECD STAN; www.oecd.org/sti/stan) about the share of the automotive industry relative to exportations is helpful but not complete. Data for Slovenia, Serbia and Romania were missing. After longer consideration at our data, irregularities in period 2000-2002 for mostly all countries were noticed. Explanations could be that a time of crisis cuts down the economy. This "dotcom bubble" (internet bubble), which was responsible in March 2000 for a worldwide depression where a lot of small investors lost their money.

Conclusions

This paper has focused on the impact of auto clusters on countries productivity in the CEE region using a panel data analysis with three different estimations models. GDP per Capita, FDI for the automotive industry (Nace Code 34), total employment, employment by the automotive industry (Nace Code 34), capital stock, education and production rates of the automotive industry were analyzed over the 1995-2006 (60 observations). We contribute to the literature by analyzing the sectoral impact of automotive FDI on economic development, while most previous studies only investigate the impact of aggregate (general) FDI.

Applying panel data analysis we found for most countries statistical significance at 1 percent. But we must mention the poor data, differences in measuring methods and our closer look was only valid for five countries from CEE. Important to mention is also the large dependence of the countries on the sector, in some countries 20 % of the exports counts as automotive production industry. After all, our variables gave proof of growth of productivity; the automotive industry is engine of growth.

For the countries depending on this activity, hard times are ahead. Cost pressure, the buzzword of today, will let the industry migrate to the country with the lowest wages. At the moment the automotive industry is under heavy strain on a global level. The success of attracting high FDI levels in the automotive industry also implies a high concentration risk in the current downturn. Given that the major automotive investors in CEE have a long-term regional strategy, and that their plants in CEE are the most modern and productive ones, we think that the automotive strategy is a good long-term bet for the host countries economies.

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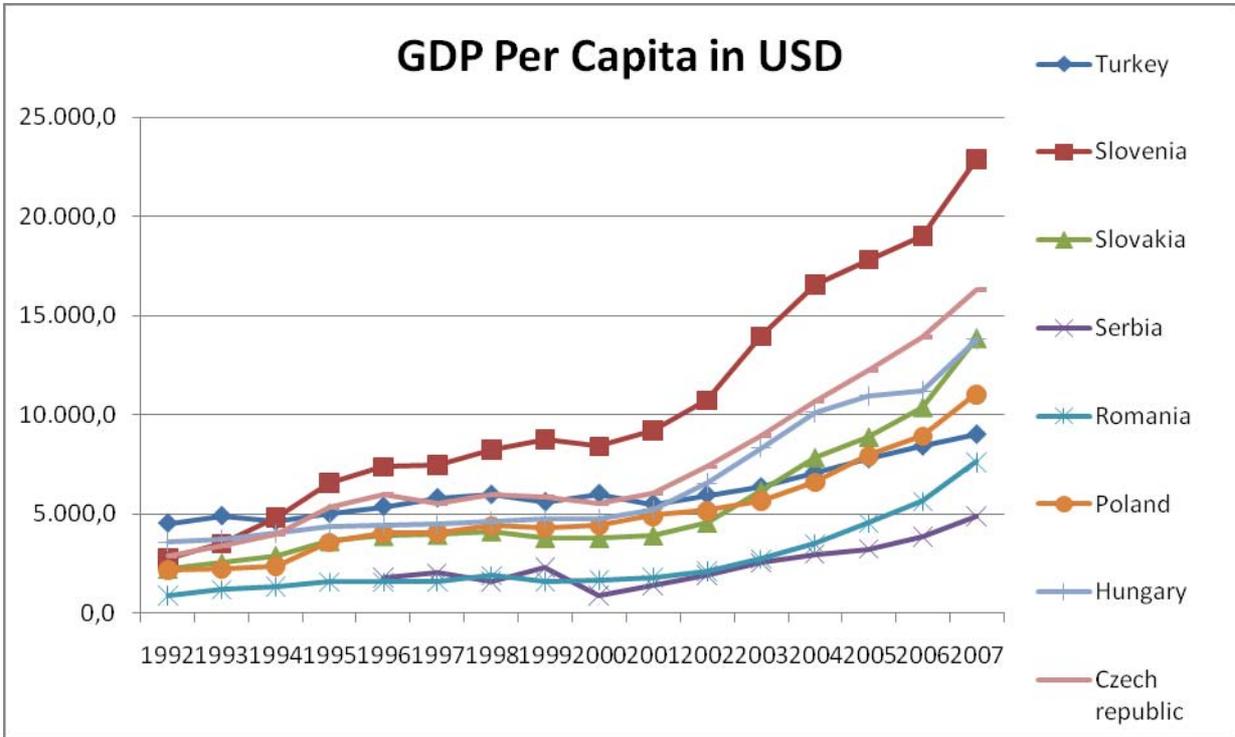
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Figures

Figure 1: Growth of GDP per capita



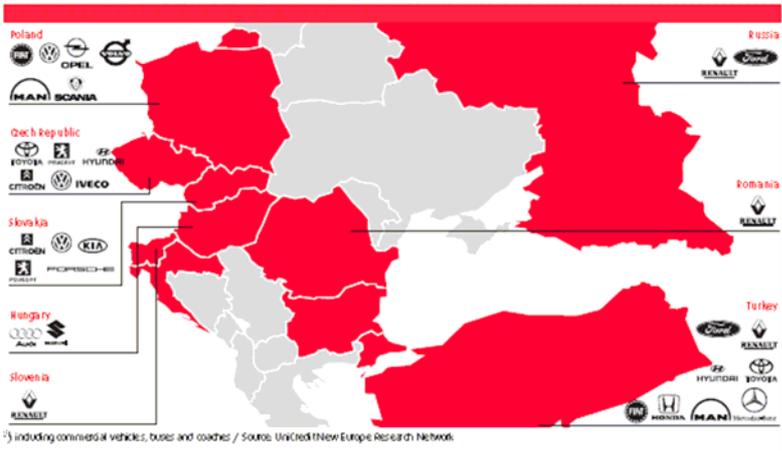
Sources: EBRD, Selected Economic factors 1992-2007

Figure 2: Automotive Clusters in CEE



Source: Ernst & Young (2007)

Figure 3 OEM (Original Equipment Manufacturer) Presence in CEE



Sources: UCI (2007)

Figure 4: Automotive FDI inward stock in CEE

Figure 5: Share of automotive FDI

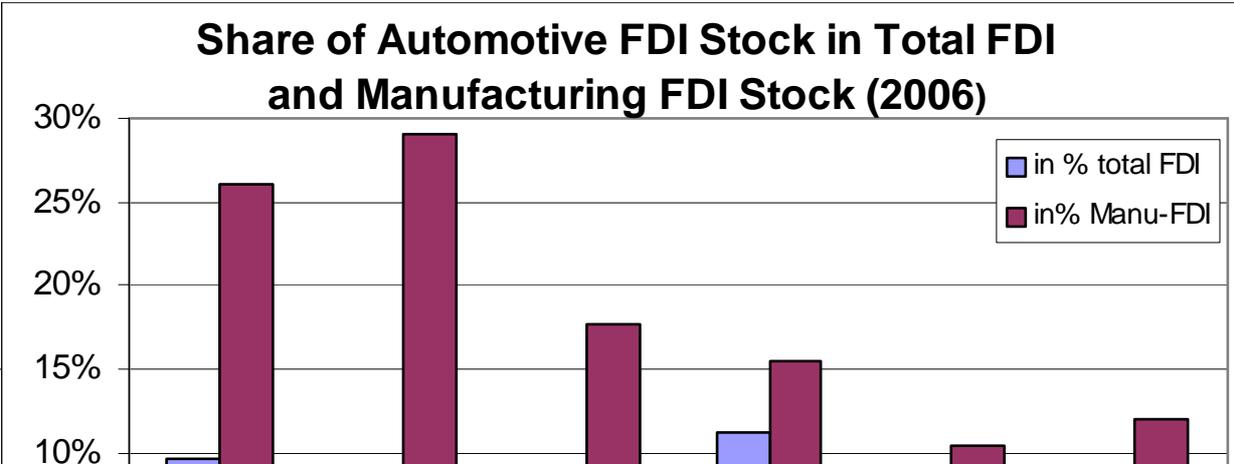
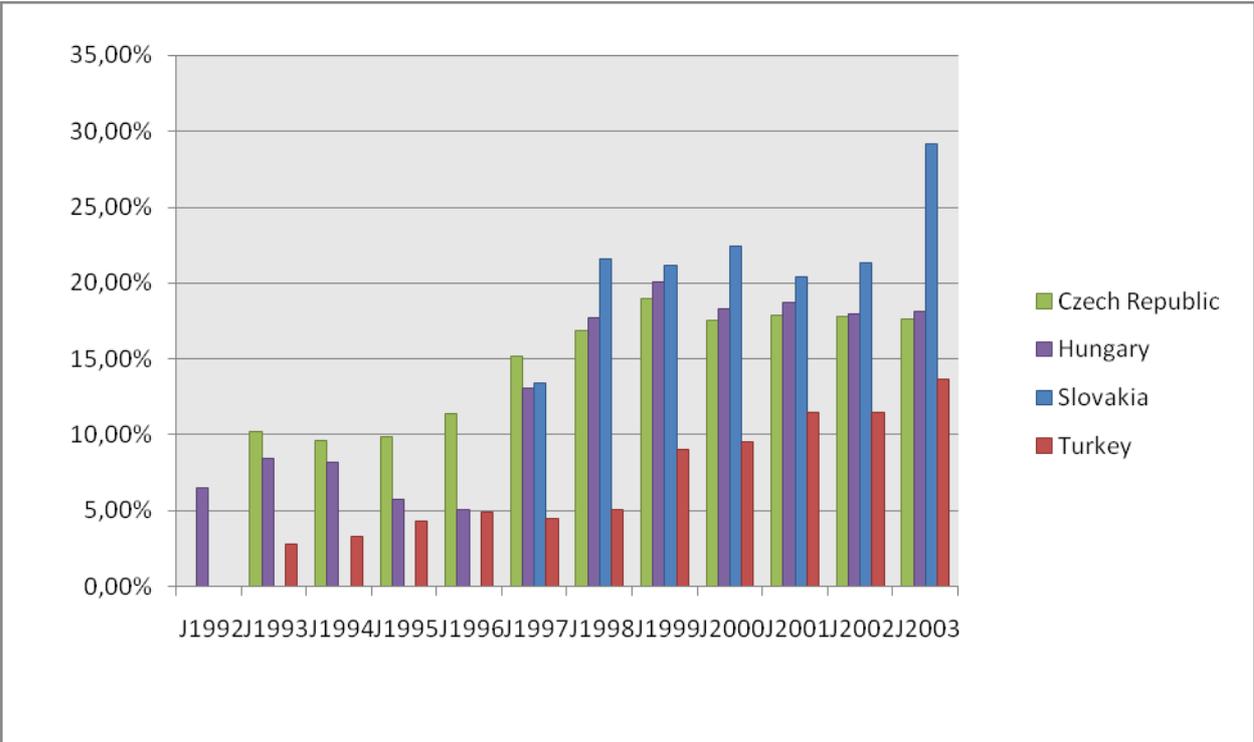
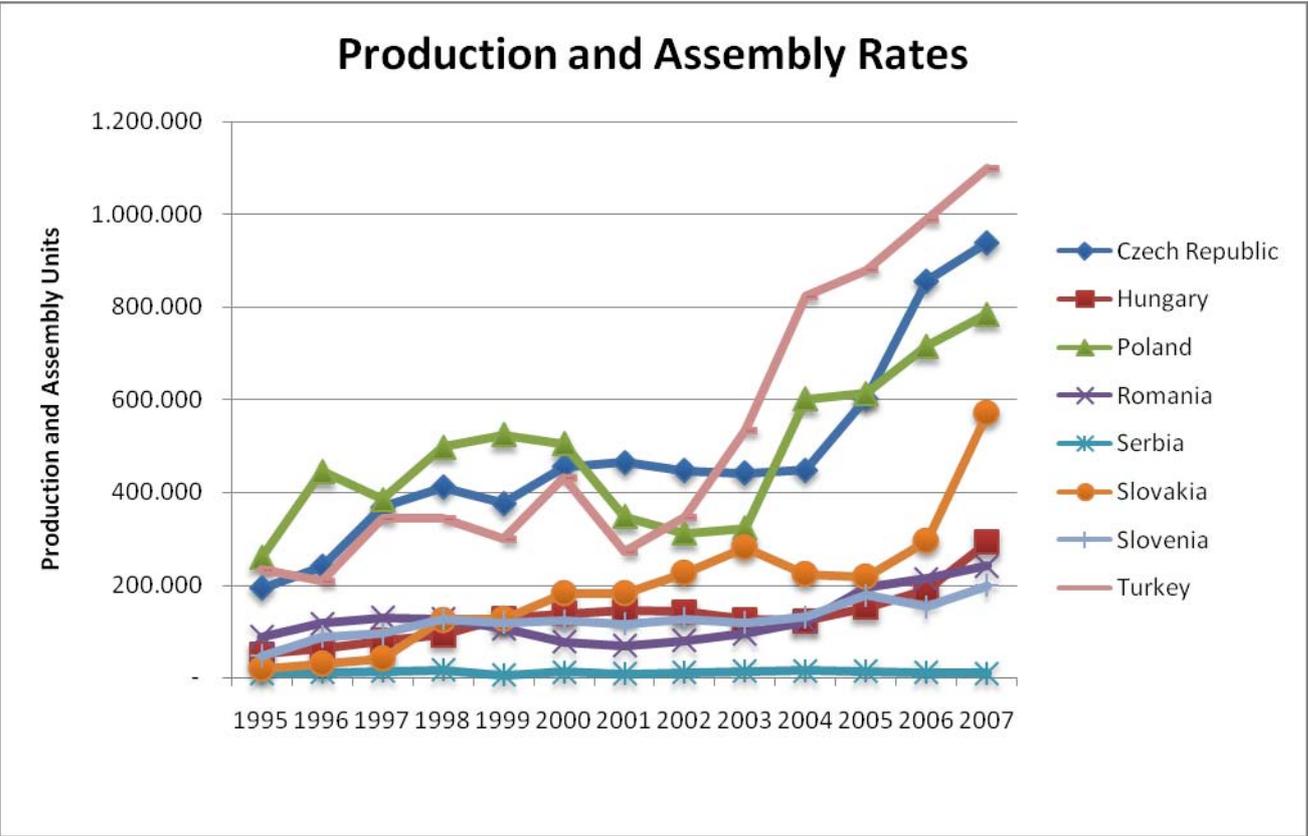


Figure 6: Share of Automotive Industry in Total Exports



Data Sources: The OECD STAN database for Industrial Analysis

Figure 7: Productions and Assembly Units for the years 1995-2007



Data source: OICA

Table 1: Production Units per Employee

Year	Czech Republic	Hungary	Poland	Romania	Slovak Republic	Slovenia	Turkey
1993							6,07
1994							5,92
1995	3,40		2,61		1,53	6,44	8,70
1996	4,07		4,55		2,27	12,03	7,63
1997	5,92		3,72	1,25	3,05	13,48	6,62
1998	6,12	2,67	4,85	1,40	8,90	17,37	8,95
1999	5,43	4,00	5,23	1,24	8,95	16,87	6,14
2000	5,80	4,13	5,23	1,03	12,41	18,31	7,10
2001	5,48	3,88		0,92	11,53	17,64	
2002		3,83	3,90	1,13	11,69	17,97	
2003	4,91	3,19	3,79	1,55	12,31	16,76	
2004	5,03	2,99	5,91	1,92	9,87	17,09	
2005	6,28	3,54	5,66	3,20	9,37	21,31	

Sources: OICA, Production Statistics 1995-2007; OECD, Structural Indices for Industry and Services, 1993-2000

Table 2: Selected Studies on FDI Productivity

Studies	Country/Industry	Data/ Econometric Technique	Result of the research: Effects of Inflow FDI
Buckley et al (2007)	China Automotive Industry	(1995-1999) POLS and FES	Inward FDI has positive role in raising labor productivity
Chung, Mitchell & Yeung (2003)	America's automotive component industry	(1982-1991) Year-by-year Productivity Regression	Positive technology transfer Inward FDI raises host industry productivity
Castejón and Woerz (2006)	OECD, Asian and Easter countries	(1987-2002) Industry Level GLS Estimations	FDI alone rarely translates into higher output or productivity, however interacted FDI has positive relationships
Kornecki and Rhoades (2007)	Central and Eastern Europe Industry	Real GDP & FDI Stock Correlation by country	FDI play positive role
Radosevic and Rozei (2005)	CEE Automotive Industry and OEM	(1990-2003) Industry Level	Overall effects of FDI on growth, restructuring and employment in industry are positive

Table 3: Results of the correlation test

	GDP per Capita	FDI_34	CS_Total	Educ	L_Total	L_34	Prod per Capita
GDP per Capita	1,00						
FDI_34	0,61	1,00					
CS_Total	0,37	0,56	1,00				
Educ	0,47	0,57	0,30	1,00			
L_Total	0,41	0,22	0,58	0,02	1,00		
L_34	0,49	0,62	0,89	0,22	0,71	1,00	
Prod per Capita	0,70	0,33	0,34	0,37	0,64	0,59	1,00

Table 4: Description of Variables

Name of Variable	Description	Unit	Source	Mean	Standard Deviation
GDP_CAP	Gross Domestic Product per Capita	USD	EBRD Database	7.466,32	3.768,15
FDI_34	Foreign Direct Investment Inward Stock 34 MOTOR VEHIC., TRAILERS & SEMI- TRAILERS (Nace Code 34+35)	Euro Millions	WIIW Database and Statistical Offices	1.472,42	1.678,02
CS_TOTAL	Real Physical Capital Stock	USD	OENB & Estimations of Markus Eller	183,97	146,94
EDUC	Weighted index of highest level of education attained by employees, age: 15-64.	Units	Eurostat-LFS	143,86	2,72
L_TOTAL	Employment of Total economy (National accounts)	Units of 1000	AMECO Database	4.106.036,83	3.437.543,75
L_34	Employment in Manufacture of motor vehicles, trailers and semi-trailers (Nace Code 34+35)	Units of 1000	OECD.stat	48.331,59	36.823,14
PROD_CAP	Production Rates and assembly	Units	OICA	260.604,93	189.809,53

Table 5: Results of Hausman's test

---- Coefficients ----				
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	fixed	.	Difference	S.E.
-----+-----				
cs_total	.6588176	-.4262266	1.085044	.
l_total	.6301338	1.131051	-.5009168	.
educ	5.205484	6.58028	-1.374796	.
fdi	.1042114	.1973658	-.0931544	.
l_34	.2251359	.265	-.0398641	.
-----+-----				
b = consistent under Ho and Ha; obtained from xtreg				
B = inconsistent under Ha, efficient under Ho; obtained from xtreg				
Test: Ho: difference in coefficients not systematic				
chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)				
= 21.51				
Prob>chi2 = 0.0006				
(V_b-V_B is not positive definite)				

Sources: Stata Output

Table 6: Results of Panel Data Analysis

Variables	OLS		Fixed Effects		Random Effects	
	Coefficient	Std.Err.	Coefficient	Std.Err.	Coefficient	Std.Err.
CS_Total	0,6694***	0,263	0,6860***	0,7643	0,6694***	0,263
FDI_34	0,3131**	0,58	0,1058***	0,0249	0,3131***	0,058
EDUC	-5,9771***	3,129	4,7612***	1,2217	-5,9771**	3,1293
L_Total	0,2378*	0,4066	0,2648***	0,2648	0,2378*	0,4066
L_34	-1,0984***	0,3377	0,1147***	0,1147	-1,098***	0,3377
PROD_CAP	0,5019***	0,8505	0,3558**	0,0355	0,5049***	0,085
Constant	28,2444**	12,83191	-28,1952***	5,8499	28,2449**	15,8319
R ²	0,712	-	0,3216	-	0,7120**	-
F-Test	21,84	-	179,6	-	-	-
No.obs	60	-	60	-	60	-
				*	Significant at 10%	
				**	Significant at 5%	
				***	Significant at 1%	

