

MULTINATIONALS IN A SMALL OPEN ECONOMY – THE CASE OF THE CZECH REPUBLIC (1997-2010)

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This paper analyses the role and behaviour of multinationals in the Czech Republic. Using firm-level data (innovation survey waves 2001, 2003, 2006, and 2008) we applied a structural model that describes the link between innovation and productivity (CDM model). Multinationals are more hesitant than domestic firms when deciding about innovation. Those multinationals that decided to innovate invested more per employee than domestic firms; their labour productivity advantage is rather ambiguous. The next analysis focused on productivity, wages and market concentration in the sample of firms representing not only innovators, but the whole Czech economy (1997-2010). On average, multinationals are more productive, pay higher wages and have no impact on market concentration. However, in a detailed view, multinationals increased market concentration in the first period (1997-2003) and had significantly lower productivity in the years of economic crisis. These results suggest a close relationship between the multinationals behaviour and economic fluctuations. A long term and short term relationship between FDI and real GDP was observed.

Keywords: multinationals, innovation, R&D, productivity, concentration, foreign owned company, small open economy, developing country

Introduction

Capital inflow has been changing the structure of the Czech economy since 1998. This paper analyses the presence and behaviour of multinationals (foreign owned companies) in this small open economy. We are particularly interested in the innovation behaviour of multinationals and their productivity. This will be compared with the behaviour of local innovators based on a representative sample from the relevant economy. We also examine the productivity, sales, and wages of multinationals in comparison to a representative selection of Czech owned companies. The goal of this exploratory study is to estimate the influence of multinationals in the rather young economic history of the Czech Republic. We will also describe their behaviour and interpret the results in a broader sense. We will utilize two data samples (innovators, all firms) that cover about 14 years (1997-2010).

We will test three hypotheses: (1) Multinationals decide more often not to have any R&D expenditures than national firms in small open economies, (2) multinationals are more productive and pay higher wages in small open economies, (3) multinationals decrease market concentration in small open economies (measured by a 3- digit, industry- based Herfindal index).

More micro-econometric models will be employed to help understand the presence of multinationals. This paper is not designed to present a detailed econometric background. It will

utilize several proven- to- be- useful models which, together, will provide a unique view on multinationals in the economy. All the tested hypotheses are based on mainstream neoclassical economic theory (productivity, profit seeking, and rational choice), the importance of private ownership, and competition. We also try to encompass and discuss some of the theories dealing with entrepreneurship and market dynamics (Acs et al 2009; Boettke & Coyne, 2003; Boudreaux et al 1989; Kirzner 1997).

We assume that all firms are profit motivated and seek opportunities in a changing environment. Those firms can be divided according to the nationality of the owner. A multinational is a firm with the majority share (more than 50 %) owned from abroad. Multinationals are seen as a “special case” of entrepreneurs. They might be encouraged by government FDI incentives and other government support programmes (Zemplinerová, 2006). Multinationals possess know-how and most of them have previous long-term experience as a company (a Linder hypothesis is predicted for FDI, see Fajgelbaum et al, 2011). They are also special because technological transfer and other positive externalities are expected (Djankov & Hoekman, 1998; Zemplinerová, 2006).

The experience of multinationals reflects in their confidence and investment activities. To some extent, this experience ensures them at least an effective employment of production factors. However they don't possess much knowledge about local informal institutions. This is a crucial incentive for governments to ensure stable, efficient and easily understandable formal institutions. With “good institutions” there might be little room for corruption, a black market and mafia- like structures. There is evidence that multinationals are agents of prosperous change for host-country institutions (Kwok & Tadesse, 2006; Zemplinerová, 2004).

Previous research suggests that multinationals are usually entering the economy with new- to- the- market technology (at least in the form of know- how) and they don't have to necessarily start their in-house R&D projects (Srholec, 2005; Zemplinerová & Hromádková, 2012). In time, the motivation for foreign companies to do their internal R&D projects in the host country may occur due to cheaper high-skilled personnel and government support.

Multinationals and economic development

First of all, in this paper no causality is ever to be found. Entrepreneurs, national or multinational, cannot be the “cause” of economic development in an economy because they are an essential part of it (Boettke & Coyne, 2003). Entrepreneurship is in the human nature and it always will be present. There is no need to construct hypothetical worlds where human nature doesn't exist. This teaching is based on the classical heritage of Richard Cantillon, Adam Smith, and John Stuart Mill.

Because we are usually interested in the wealth of a nation (at least as an economist, not necessarily as a politician) we can only make it better or worse for all the entrepreneurs, including multinationals. It means that we are looking for factors that ensure economic growth in a peaceful environment with suitable institutional infrastructure for everyone. For multinationals to exist, this environment has to be tolerant and open to foreigners. If this is the case, then multinationals are simply entrepreneurs like all others. They rise, they cease to exist, they are successful, and they seek new profit opportunities in simultaneous supply-demand & demand-supply global market environments. They are special in some aspects for developing countries because they are messengers of social and technological change.

On a macroeconomic level, FDI and technology inflow is a dynamic process and can stimulate local entrepreneurs (Acs et al 2009). Potential competitors and new firms can

cooperate, be part of the supply chain, and also imitate (both in a good and bad way) foreign firms' know-how and technology. This learning process (Arrow's "learning-by-doing concept", 1962) can usually help the SME's (small and medium enterprises) catch up to global competition and exploit new opportunities by themselves.

This view is important for politicians who influence the institutional infrastructure. Arrow's (1962) paper deals with basic research and argues in favour of state intervention in basic (generic) research. However, entrepreneurs from abroad are more likely to be sources of applied research (specific knowledge) rather than the generic type. There is no reason to support them and favour them over local entrepreneurs. The only reasonable and justifiable policy (following Arrow's argument) would be to give entrepreneurs, regardless the nationality, the opportunity to participate in basic research.

A debate about the importance of specific research (new- to- the- market innovations) is a popular matter in the field of intellectual property rights (Scotchmer, 2004). For economists there is an interesting cost benefit analysis underneath the law & economics debate; how to calculate and what influences the ability to capture profits generated by an innovation, i.e. the appropriability (Cohen, 2000). Attracting FDI might be the source of specific research but it is appropriability - the simple profit (whatever nature of profit it is) that is interesting for entrepreneurs.

We are back in the debate about what the best conditions for entrepreneurs to capture their profits are. We know it is a dynamic process where competition and new technologies are present. There are positive and negative effects which are interlinked with the current institutional infrastructure. There are good and bad government policies which affect all the entrepreneurs not only the foreign one. Let's have a look at a case study of a small open economy where we build upon the neoclassical theory, and multinationals are studied in detail.

FDI inflow in Czech Republic

According to Czech Statistical Office (CZSO) the share and influence of multinationals has been growing rapidly since 1998. In our sample (Figure 1) there are about 22.7 % of them with sales share over 45 % in 2010. The fall of communism in 1989 started a costly transformation and development of a new type of small open economy - Czechoslovakia. In 1993 the Czech Republic emerged. The capital inflow and structural changes shape a new democracy. Social change and technological innovation began to influence everyday life. The Czech Republic (CR) was a catching- up economy facing dramatic institutional changes in its early years of existence. Political representation chose to pursue a liberal and entrepreneur- friendly model of economy. In fact, serious state intervention in prices and in the form of state ownership was still present; however, it was a good enough political declaration for multinationals to take the risk and invest here.

On average, foreign companies are more productive (in terms of sales per employee) and pay higher wages per employee (Figure 1). These firms invested more than half of all the money in the economy to new, fixed and intangible capital in 2010. That year multinationals employed more than 40 % of Czech inhabitants and their share on total sales was around 57 %. These numbers are rough and come from a limited data sample (see chapter Data); however, they give a very good overall look at the Czech economy and are in accordance with official CZSO (2012) press release.

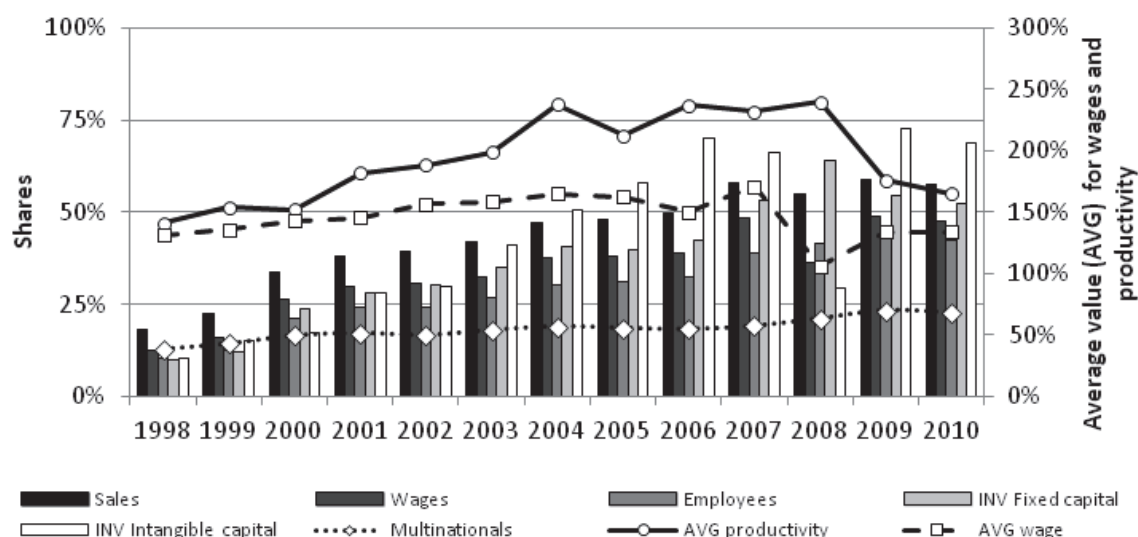


Figure 1. Multinationals in CR 1998-2010, % shares of total, % average value in comparison to locals.

Data: CZSO questionnaires P5-01. **Notes:** Right vertical axis is linked with AVG productivity and AVG wage. Sales represents sales of own goods (N=392332), Wages represents wage costs without other personal costs (N= 390536), Employees are as an average evidential number (N=392332), INV Fixed capital represents new investments in fixed capital (N=361230), INV Intangible capital represents new investments in intangible capital (N=328313), Multinationals are defined by institutional sector - share of foreign capital 50-100 % (N= 377697), AVG productivity indicator consists of sales per employee and it shows average relative % value (N=392332), AVG Wage shows average relative % value (N=390536) of total wages per employee.

Long term relationship between FDI inflow and GDP

There is a very strong relationship between two macroeconomic aggregates, FDI and GDP, (Figure 2) in the Czech Republic. On a macroeconomic level the year 1998 is observed to be a starting point of massive FDI inflow. Since 2002 there have been visible fluctuations. Both time series are random walks and are co-integrated¹. Even within this very short period of time, 1993-2012, we can observe a statistically significant long term relationship between them (Table 1).

$$\begin{aligned}\Delta y_t &= \beta_{y0} + \beta_{yy1}\Delta y_{t-1} + \beta_{yx1}\Delta x_{t-1} + \lambda_y (y_{t-1} - \alpha_0 - \alpha_1 x_{t-1}) + v_t^y, \\ \Delta x_t &= \beta_{x0} + \beta_{xy1}\Delta y_{t-1} + \beta_{xx1}\Delta x_{t-1} + \lambda_x (y_{t-1} - \alpha_0 - \alpha_1 x_{t-1}) + v_t^x.\end{aligned}\quad (1)$$

We used VEC model² (Johansen, 1995) for our analysis. Both series are moving together and there is a mechanism of going from short term disequilibrium towards long term

¹ MacKinnon P-value for GDP = 0.3326, and for FDI = 0.5318 indicating presence of unit root. Rank of co-integration was determined using the maximum eigenvalue statistic (STATA VECRANK command).

² Lag-order selection statistics help construct final VECM model with 1 and 5 lags. Both models (using equation 1) passed the post-estimation test for normally distributed disturbances (Jarque-Bera test) and test for autocorrelation in

equilibrium. The long term relationship was estimated (Equation 1) with a constant, using standard pre- and post- estimation procedures.

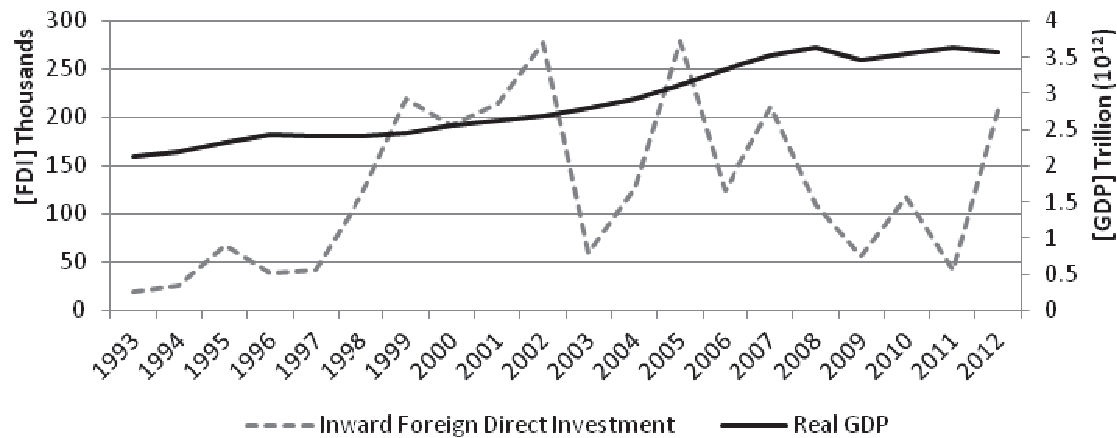


Figure 2. Log term relationship between real GDP and FDI inflow.

Data: CZSO and Czech national bank, financial data is in local currency [CZK], real GDP in 2005 prices, FDI in thousands and GDP in trillions (10^{12}).

In the short term, a Granger analysis is possible in VEC models 3 and 4 (Table 2). These results suggest that past values of GDP (altogether) have no influence on future FDI inflow (χ^2 test of 4 lagged variables of Δ GDP). On the other side, there is a statistically significant relationship (χ^2 test of 4 lagged variables of Δ FDI) with FDI. Past values of FDI influence GDP; however, this influence is not straightforward. In the case of constant FDI inflow, a negative overall effect of past values is present.

Table 1. VEC Models for Czech Republic, 1993-2010, real GDP and FDI inflow.

VEC Models	(Model 1) C	(Model 2) RC
$\lambda_y (\Delta \text{GDP}_{t-1})$	-0.0115* (0.00683)	-0.0322*** (0.00850)
Constant	61614.6*** (21733.0)	
$\lambda_x (\Delta \text{FDI}_{t-1})$	0.0200*** (0.00648)	0.0131 (0.00913)
Constant	35321.9* (20620.3)	
Johansen	GDP = -246921.3 + + 35.45838* FDI + λ	GDP = 2117072 + + 20.37931* FDI + λ

Note: Standard error in the parentheses, 19 observations, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, Consistency test included residual normality test and autocorrelation test, both models seem consistent, Trend: C – constant, RC – restrictive constant, FDI – inflow of foreign direct investment.

the residuals (Lagrange-multiplier test). Model with 1 lag had both the lambdas [$\lambda_y (\Delta \text{GDP}_{t-1})$ negative and $\lambda_x (\Delta \text{FDI}_{t-1})$ positive] terms significant for relevant Johansen normalization equation. The 5 lag model (Table 2) was consistent but gave insignificant error correction term (ECT2).

Table . Short term analysis of FDI and GDP in VEC models for Czech Rep. in 1993-2012

VEC models	GDP		FDI	
	(Model 3) T	(Model 4) RT	(Model 3) T	(Model 4) RT
ΔFDI_{t-1}	0.322*** (0.121)	0.331*** (0.118)	ΔGDP_{t-1}	-0.0233 (0.333)
ΔFDI_{t-2}	-0.255 (0.157)	-0.258* (0.145)	ΔGDP_{t-2}	-0.179 (0.390)
ΔFDI_{t-3}	-0.0992 (0.154)	-0.105 (0.147)	ΔGDP_{t-3}	-0.806** (0.361)
ΔFDI_{t-4}	-0.853*** (0.132)	-0.853*** (0.133)	ΔGDP_{t-4}	-0.0978 (0.805)
				-0.283 (0.450)
				-0.270 (0.565)
				-0.515 (0.480)
				-0.687 (1.092)

Note: Standard error in the parentheses, 19 observations, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, Consistency test included residual normality test and autocorrelation test, both models seem consistent, Trend: T – linear trend, RT – restrictive trend, FDI – inflow of foreign direct investment.

This can be interpreted in a sense of bad investment decisions and a bad institutional setting and/or an inadequate state policy. Some FDIs were simply not successful and investors left. Some were problematic, unsuccessful and there were many arbitration cases where investors tried to protect their investments. The most famous is CME versus Czech Republic and there are more cases listed at MFCR (2012).

The immediate positive effect of FDI on GDP has also been falling off in subsequent years because of the government short term benefits for foreign investors (tax reliefs and “tax holidays”, subventions, zero rents, and so on...). After exploitation of the benefits, they shut down the business, or move farther away to another low cost country. This leads to ineffective state support and excessive demands on the state budget.

There are cases of state failure in FDI policies as a by-product of other policies. If a country can simply change its views on property rights, then multinationals are more likely to limit their operations in such a country (for example: disinvestment in Latin America, see Manzano, O., & Monaldi, F., 2009). Attracting or expropriating multinationals might seem to be a good policy; however it is short-sighted and can harm the economy. More negative effects are discussed in Schwarz et al (2007).

Multinationals and Innovation

The method and model for innovation analysis follows an augmented CDM model (Crepon et al. 1998, Hashi a Stojcic, 2010). There are equations (Equation 2) which represent and model the innovation process. For first two equations we used a generalized Heckman procedure. For the last two equations we used three stage least square procedures (3SLS, Zellner a Theil, 1962). Bootstrapping (Efron, 1979) produced robust standard error.

$$\begin{aligned}
 \text{I. } \quad & \left\{ \begin{aligned} r_i^* &= \begin{cases} 1 & \text{if } r_i = (X_{1i}\beta_1 + s_{1i}) > 0 \\ 0 & \text{otherwise } (r_i \leq 0) \end{cases} \\ k_i^* &= \ln(k_i) | (r_i > 0) = X_{2i}\beta_2 + s_{2i} \text{ with } Df(k_i) = (0, \infty) \end{aligned} \right. \\
 \text{II. } \quad & \left\{ \begin{aligned} t_i^* &= \ln(t_i) | (k_i > 0) = X_{3i}\beta_3 + \alpha k_i^* + s_{3i} \text{ with } Df(t_i) = (0, \infty) \\ g_i^* &= \ln(g_i) | (t_i > 0) = X_{4i}\beta_4 + \gamma t_i^* + s_{4i} \text{ with } Df(g_i) = (0, \infty) \end{aligned} \right.
 \end{aligned} \tag{2}$$

The first function (r^*) denotes an indicator function (Probit - decision to innovate and OLS - innovation expenditures intensity) and split the sample into innovators (non-zero R&D expenditures) and non-innovators. Then innovation intensity (k^* - R&D expenditures per employee) is estimated using Ordinary Least Squares (OLS) procedure. We used Mill's ratio (form Probit) in the second step and in the 3SLS procedure to correct for sample selection. In 3SLS there are 3 steps for creating reduced and structural forms for re-estimating residuals in the last step. Identification follows recommendations in Hashi and Stojcic (2010). $X_{ni}\beta_n$'s (with $n = 1, 2, 3$, and 4) denote vectors of explanatory variables and ε_{in} 's are random-error terms.. The third equation (t^*) deals with sales from innovated goods. The fourth equation (g^*) deals with sales (of goods and services) per employee – productivity of innovators.

Table 2. Innovation data for Czech Republic.

Structure of data	2001	2003	2006	2008	Sum
TI Innovation data – full	3618	3644	6813	6782	20857
Manufacturing sector	1637	2091	2819	2766	9313
Heckman procedure	1501	1655	2385	2333	7874
Innovators only	521	606	918	943	2988
3SLS procedure	479	604	525	810	2418

Data: CZSO (P5-01, TI)

Data was obtained from the Czech Statistical Office (CZSO). The Czech “TI” questionnaire is the same as the European CIS, i.e. the one for Community Innovation Survey (CIS). The “P5-01” questionnaire is the one containing firms’ financial data. In the innovation data sample we didn’t include services. They have a different nature in the innovation process (Ettlie a Rosenthal, 2011) and, for example, in the Czech financial sector, there are very few local service firms for comparison. On average 86 % of all the available data was used (Table 3) for the Heckman procedure. For 3SLS procedure there is a quite significant 35 % data loss. The main problem was in joining the financial data using another questionnaire. For some of the companies no such data existed. We decided to clear the dataset and got rid of the firms with zero sales, zero employees, and zero fixed assets.

Table 4. Summary statistics for manufacturing (NACE 15-37), 1999-2003.

Variable	Observations	Mean	Std. Dev.	Min	Max
Employees	3156	368.9449	821.2606	5	23165
Sales	2903	855203.2	4502048	612	1.53e+08
Sales per employee	2903	2020.171	14288.51	38.25	755723.4
Innovator	3335	0.3475262	0.476256	0	1
HHI	3335	1053.625	1329.955	99.93182	10000
Fixed Capital	2864	292045.9	1264004	1	3.43e+07
Multinationals	3335	.307946	0.4617133	0	1
Public firm	3335	0.0128936	0.1128323	0	1
R&D expenditures	3335	10530.55	79483.74	0	3911974
Process Innovation	3335	0.2830585	0.4505522	0	1
Abandoned Innovation	3335	0.2794603	0.4488013	0	1
Product Innovation	3335	0.4242879	0.4943085	0	1
New to the market	3335	0.194003	0.3954905	0	1
New to the firm	3335	0.4215892	0.4938875	0	1

Data: CZSO (P5-01, TI)

A summary statistics overview (Table 4 and 5) is presented for two periods 1999-2003 and 2004-2008. In the first period there were about 31 % of multinationals in the data sample and the

average firm size was characterized by 369 employees. Product innovation dominated the manufacturing sector and about 28 % of innovation projects were abandoned. New- to- the- firm innovation as a lower level type innovation was more common (42 %) and exceeded the higher type of innovation which was the new- to- the- market innovation (only 19 %).

In the second period (2004-2008) the average size of the firm was lower (304 employees v. 369). The share of multinationals had increased to 39 %. Generally, all financial data has increased (sales, productivity, capital and expenditures). There are more innovators than in the previous period. More innovation projects were abandoned and again product innovation dominated this industry. The share of the new- to- the- market innovation has increased from about 19 to 26 %. There are less new- to- the- firm innovations in comparison with first period. This is probably because in the first period there was a lot of new technology and many structural changes. The “new to the firm” innovation could have been more easily decided. In the second period this might have been more difficult to decide. The lower average concentration ratio measured by the Herfindahl index (HHI) in the second period is worth mentioning.

Table 3. Summary statistics for manufacturing (NACE 15-37), 2004-2008.

Variable	Observations	Mean	Std. Dev.	Min	Max
Employees	4878	304.106	701.6148	10	25486
Sales	4525	964508.3	5176538	8	1.88e+08
Sales per employee	4525	2558.37	17973.6	0.3333	1173069
Innovator	4878	0.494	0.5000	0	1
HHI	4878	889.958	1131.502	62.0778	10000
Fixed Capital	4440	280809.8	1147217	1	4.03e+07
Multinationals	4878	0.388	0.4873	0	1
Public firm	4878	0.007	0.0856	0	1
R&D expenditures	4878	19624.24	143974.4	0	5740915
Process Innovation	4719	0.328	0.4697	0	1
Abandoned Innovation	4719	0.319	0.4661	0	1
Product Innovation	4481	0.404	0.4907	0	1
New to the market	4878	0.259	0.4377	0	1
New to the firm	4878	0.281	0.4497	0	1

Data: CZSO (P5-01, TI)

There is about a 10- percentage point lower probability (Table 6) for foreign companies to have R&D expenditures and innovate (had non-zero R&D expenditures). In the second step, if they decided to have R&D expenditures, their R&D intensity (expenditures per employee) was about 38.7 % higher than an average local firm. We can see a bit negative development in terms of multinationals. More of them decided not to innovate and their innovation intensity is about 10 % lower in the second period (2004-2008).

Table 4. Decision to innovate and innovation intensity (R&D expenditures per employee).

Years	Decision to innovate				Innovation intensity			
	1999-2003		2004-2008		1999-2003		2004-2008	
Multinational	-0.084 (0.018)	***	-0.110 (0.020)	***	0.476 (0.188)	**	0.387 (0.107)	***
HHI	9.40E-06		1.58E-05		-1.82E-05		9.47E-05	**
HHI squared	4.19E-10		-2.16E-09		8.84E-09		-3.76E-10	
Employees (ln)	0.091 (0.007)		0.125 (0.007)	***	-0.318 (0.094)	***	-0.304 (0.050)	***
Public firm	0.040 (0.062)		-0.105 (0.094)		0.353 (0.355)		0.435 (0.445)	
Trend	-0.321 (0.022)	***	0.002 (0.016)		0.159 (0.258)		-0.117 (0.101)	
Mill's					-0.367 (0.306)		-0.062 (0.175)	
Constant					4.625 (0.821)	***	4.746 (0.430)	***
Other	<i>G, M, H</i>				<i>G, M, I, S, F, A, C</i>			

Data: CZSO data from CIS waves 2001, 2003, 2006, and 2008. **Note:** Decision to innovate - Marginal effects, robust standard error are in parentheses below coefficient. Innovation intensity - robust standard errors are in parentheses below coefficient. Other variables: G – Part of a group, M – market orientation, H – Hampering factors, I – Information sources, S – Innovation strategy, F – public funding, A – abandoned innovation project, C – cooperation.

Table 5. Innovation output intensity (R&D sales) and productivity (sales per employee).

Years	Innovation output				Productivity			
	1999-2003		2004-2008		1999-2003		2004-2008	
Multinational	0.348 (0.114)	***	0.066 (0.076)		-0.169 (0.085)	**	0.061 (0.054)	
HHI	4.63E-06		-6.6E-05	**	1.38E-04	**	0.000085	**
HHI squared	1.11E-08		1.9E-08		-1.29E-08		-8.6E-09	
Employees (ln)	1.014 (0.045)	***	1.018 (0.039)	***	-0.220 (0.102)	**	-0.451 (0.097)	***
Public firm	-0.128 (0.253)		-0.618 (0.394)		0.080 (0.111)		0.135 (0.177)	
Trend	-0.267 (0.071)	***	0.087 (0.066)		-0.069 (0.079)		-0.110 (0.033)	***
Mill's	0.343 (0.144)	**	0.138 (0.151)		1.092 (0.318)	***	0.106 (0.202)	
Constant	4.198 (0.856)	***	-0.547 (0.699)		0.210 (0.783)		3.615 (0.524)	***
Productivity (ln)	0.649 (0.112)	***	0.694 (0.112)	***				
Capital intensity (ln)					0.225 (0.024)	***	0.188 (0.028)	***
Innovation intensity (ln)	Innovation Input		Innovation output		Innovation output		Innovation output	
	0.104 (0.020)	***	0.084 (0.020)	***	0.387 (0.072)	***	0.448 (0.088)	***
Other	<i>M, G, C</i>				<i>M, G, C, H</i>			

Data: CZSO data from CIS waves 2001, 2003, 2006, and 2008. **Note:** Bootstrapped robust standard errors are in parentheses below coefficient. Other variables: G – Part of a group, M – market orientation, H – Hampering factors, C – cooperation.

The second part of the innovation behaviour analysis of multinationals is in the Table 7. We can observe about 35 % higher innovation sales for innovating multinationals in the first period. In the second period it dropped to zero and, in fact, there was no significant relationship. Labour

productivity was lower for innovating multinationals by about 17 % and in the second period no statistical relationship was present.

Multinationals and productivity, wages and market concentration

A model was used for the production analysis, regardless of being an innovator. A production function (Van Beveren, 2012), wages function and Herfindal index function was estimated. We used 3 standard fixed effects and random effect panel estimation. A decision to trust a random effect model was based on the Hausman specification test (Hausman, 1978) and Sargan-Hansen statistic (Arellano, 1993). In case the Hausman test couldn't give a definite value due to problems with the computation matrix (i.e. the χ^2 statistics value computation is questionable due to severe heteroskedasticity in FE OLS model), the Sargan-Hansen statistic was used to check the consistency of possibly more efficient random effect estimation. Reported robust standard errors were proposed by Arellano (1987) i.e., robust to cross-sectional heteroskedasticity and within-panel (serial) correlation.

The second dataset contains firms (CZSO "P5-01 questionnaires") doing business in the Czech Republic in the years 1997-2010. This data set was needed for the production function analysis and the rest of the hypotheses. Full representativeness is a CZSO responsibility; however, they cannot fully capture the dynamic process of firm entering and leaving the market. Another problem posed the representativeness of very small firms (less than 10 employees). Some of the reasonable zero employees firms (about 8 % observations) were kept in the sample. Per employee variables (for zero employees) had to be treated as if they would have 1 employee.

Since we have zero values in our sample, the standard and practical logarithmic transformation was not possible. The inverse hyperbolic sine transformation was used, which has properties similar to the logarithmic interpretation. Johnson and Rausser (1971) proposed the equation⁴ for the transformation process. It then has about negative hyperbolic sine function properties. An exact inverse transformation is possible.

We have 14 years in the panel (Table 8). This period from 1997 to 2010 is characterized by the presence of multinationals (18.6 % of the sample). We will have a look at their influence on market concentration (HHI), and then we will explore wages, sales and labour productivity.

Table 6. Summary statistics for Czech Republic in 1997-2010, NACE (010-930).

Variable	Observations	Mean	Std. Dev.	Min	Max
Employees	392332	81.87984	611.8475	0	99020
Sales	392332	171795.6	1658813	0	2.72e+08
Fixed capital	392332	73727.27	1210990	0	1.69e+08
Intangibles	316257	2431.467	95857.73	0	2.20e+07
Material and Energy costs	388127	72124.86	1341933	0	2.68e+08
Wages	390536	14688.98	124600.8	0	1.70e+07
Investment	312683	28379.25	600418.2	0	1.39e+08
Productivity	392332	3783.901	86798.87	0	3.38e+07
Exits	85633	.0030012	.0547011	0	1

3 Panel estimation: $y_{it} = \pi_i + \beta \cdot X_{it} + \gamma \cdot controls_{it} + \mu_{it}$

Fixed effects i. e. firm specific determinants are represented by time invariant individual panel variable π_i . The error term μ_{it} represents unexplained variability, i.e. residuals. In case of random effect, the fixed time specific characteristics ($u_i \leq \pi_i$) are allowed to be in the model to produce more efficient estimation results. X_{it} denotes explanatory variables, followed by control variables.

4 $\text{Sinh}^{-1}(x) = \ln [x + (x^2 + 1)^{0.5}]$

HHI	392332	660.4679	1038.472	0	10000
Multinationals	377697	.1858792	.3890096	0	1
Public Firm	377697	.0193303	.1376833	0	1

Data: CZSO (P5-01)

Multinationals and Concentration

Table 7. Multinationals and Concentration in the Czech Republic 1997-2010.

HHI (LN)	1997-2010		1997-2003		2004-2010	
Multinational	0.014 (0.018)		0.094 (0.033)	***	-0.011 (0.021)	
Employees	0.049 (0.004)	***	0.024 (0.010)	**	0.047 (0.005)	***
Sales	-0.005 (0.001)	***	0.020 (0.006)	***	-0.010 (0.001)	***
Branch sales	-0.285 (0.003)	***	-0.283 (0.008)	***	-0.281 (0.003)	***
Fixed capital	-0.038 (0.001)	***	-0.017 (0.003)	***	-0.039 (0.001)	***
Trend	-0.039 (0.001)	***	-0.062 (0.003)	***	-0.076 (0.002)	***
Public firm	0.280 (0.047)	***	0.184 (0.105)	*	0.144 (0.072)	**
Constant	99.899 (2.108)	***	143.611 (6.152)	***	173.152 (3.304)	***
R_sq	31.73%		16.69%		38.92%	
N	377697		114073		263624	

Data: CZSO data from P5-01 questionnaires, Note: Fixed effects, robust standard errors in parentheses below coefficient

We estimated HHI as a function of ownership, branch sales and a trend (Table 9). Some individual firm characteristics were included. The only influence was observed in the first period (1997-2003) and their presence increased market concentration (about 9.4 %). Multinationals invested in traditional industries and in relatively high income regions (Schwarz et al, 2007). This process of skimming, together with structural changes, resulted in an increase of concentration (mergers, exists). During the second period and, on average over the whole period, multinationals had no effect on concentration at all. This analysis provides a rough static look at this rather dynamic process. Future researchers should include dynamic and nonlinear models. We were more interested in the immediate and easy- to- interpret, direct linear effect.

Multinationals and wages

On average (Figure 1), multinationals paid higher wages and this is confirmed in the analysis of wages in the Table 10. In the first period they took advantage of low costs and paid about 6 % higher wages. In the second period they paid about 28 % higher wages. This wage difference reflects also the costs of paying the managers who need to retain a wage standard as if they were in their home country, but the average difference is nonetheless quite remarkable.

These results suggest that the multinationals had a wage strategy in the first years of massive FDI inflows. They had to offer higher wages than alternative local employers did. They also had to attract skilled employees and seemingly invest in training because of the use of new technologies. Another aspect is the process innovations and management techniques which were relatively new to the Czech economy.

Table 8. Multinationals and Wages in the Czech republic 1997-2010.

Wages (LN)	1997-2010		1997-2003		2004-2010	
Multinational	0.466 (0.041)	***	0.058 (0.025)	**	0.277 (0.064)	***
Trend	-0.236 (0.002)	***	0.137 (0.002)	***	-0.227 (0.004)	***
Public	-0.123 (0.062)	**	-0.030 (0.036)		-0.585 (0.125)	***
Constant	480.062 (3.736)	***	-265.293 (4.517)	***	461.513 (7.592)	***
N	376512		112938		263574	
R _{sq}	4.32%		8.59%		1.10%	

Data: CZSO data from P5-01 questionnaires, **Note:** Fixed effects, robust standard errors in parentheses below coefficient

Multinationals and sales

Multinationals are characterized by higher sales (of goods and services). In comparison with their local counterparts, this difference is quite substantial (Table 11). In the first period sales were about 78 % higher and in the second period reduced to about 35 %. This reduction could be associated with the economic crisis which might have affected the multinationals harder.

There were more multinationals in the second period and some of them were originally Czech firms. These firms decided to tax their profits and incomes in tax havens (Table 12). These numbers are growing and we are not aware of the exact numbers. These numbers are rough and probably a bit underestimated because they represent only those firms which are not hiding their origin.

Table 9. Multinationals and Sales in the Czech republic 1997-2010.

Sales (LN)	1997-2010		1997-2003		2004-2010	
Multinational	0.516 (0.005)	***	0.776 (0.007)	***	0.354 (0.027)	***
Public	-1.164 (0.063)	***	-0.361 (0.079)	***	-1.323 (0.071)	***
Trend	-0.251 (0.002)	***	0.105 (0.004)	***	-0.454 (0.005)	***
Capital	0.572 (0.004)	***	0.202 (0.013)	***	0.614 (0.004)	***
Labour	0.287 (0.005)	***	0.563 (0.007)	***	0.256 (0.006)	***
Material and Energy costs	0.540 (0.009)	***	0.073 (0.023)	***	0.092 (0.009)	***
N	374292		110903		263389	

Data: CZSO data from P5-01 questionnaires, **Note:** Levinsohn-Petrin-Poi productivity estimator, standard errors in parentheses below coefficient, based on bootstrapping (50 replications)

Table 10. Number of Czech companies with the owner coming from a tax haven country, 2006-2012.

Year	2006	2007	2008	2009	2010	2011	2012
Number of firms	7334	8250	8990	11143	11424	11752	12554

Data: ČEKIA5

Table 11. Multinationals and productivity in the Czech republic 1997-2010.

Productivity (LN)	1997-2010		1997-2003		2004-2010	
Multinational	0.165 (0.055)	***	0.215 (0.037)	***	-0.312 (0.079)	***
Capital intensity	1.396 (0.005)	***	0.234 (0.013)	***	1.463 (0.006)	***
Employees	0.106 (0.011)	***	-0.094 (0.018)	***	0.105 (0.020)	***
Year	-0.278 (0.003)	***	0.067 (0.003)	***	-0.439 (0.005)	***
Public	-0.066 (0.103)		-0.126 (0.068)	*	-0.590 (0.166)	***
Constant	561.972 (5.348)	***	-121.115 (5.383)	***	884.259 (10.643)	***
N	377697		114073		263624	
R sq	47.38%		7.34%		47.54%	

Data: CZSO data from P5-01 questionnaires, Note: Fixed effects, robust standard errors in parentheses below coefficient

Multinationals and productivity

The next analysis deals with the sales of goods and services per employee – our productivity indicator (Table 13). Productivity is, on average, higher in the whole period (1997-2010) but substantively higher in the first period. However, the economic crisis had a significant impact on multinationals. They had about 31 % lower productivity than their local counterparts. Most of the multinationals in the Czech economy are financial institutions and firms from the manufacturing (car industry) sector. This significant drop suggests a significant relationship between multinationals and economic fluctuations.

Conclusions

This exploratory study tested three hypotheses about multinationals. We explored their innovation behaviour, sales, productivity, wages, and relationship with market concentration (HHI). We summarized some of the competing theories, described through context in the Czech economy, and analysed long- and short-term relationship between FDI and GDP.

5 All the data comes from ČEKIA reports and press releases. ČEKIA was Czech capital information agency. Nowadays it is a private firm called “Bisnode”. Data are relatively credible. The main data source was 2011/09 press release. More on <http://www.cekia.cz/images/tiskovezpravy/tz110929.pdf>

We confirmed the first hypothesis which states that foreign- owned companies decide more often not to have any R&D expenditures in comparison to national firms in a small open economy. This result suggests the existence of technology transfer, primary costs and strategic localization incentives. There are some multinationals which had R&D expenditures in the Czech economy and they spent more than their local counterparts.

In the first period (1999-2003), they averaged higher innovation revenues per employee. Therefore, they do not exclusively rely on their home country (external) innovation activities. In comparison with Czech innovators, they were less productive in the first period; however, most of the differences in innovation and output indicators disappeared in the second period (2004-2008).

The way multinationals affect the host country depends on their motivation, which can be affected both by a combination of exploitation of state support and favourable economic conditions. The best ways to attract them is to: (1) offer them participation in state supported basic research and (2) inform them about profit opportunities based on lower costs.

If there is no profit then entrepreneurs cease to exist. Multinationals who participated in basic research can improve their experience with technologies and innovation processes from their home country and employ (most likely cheaper and more effectively) local high skilled and administrative workers.

We also tested the higher wages and productivity hypothesis in the presence of economic cycles. During the whole period (1997-2010) it seems that this hypothesis stands unchallenged. In a detailed look the strategy of multinationals and even lower productivity in terms of wages and productivity can be observed. In the years of economic crisis, multinationals had significantly lower productivity.

The last hypothesis tested market concentration. This hypothesis wasn't confirmed. Foreign owned companies didn't decrease concentration (3 digit industry Herfindal index). In the first period they even increased their market concentration. This is in accordance with historical context (Schwarz et al, 2007) when multinationals focused on traditional industries (financial sector and manufacturing) in high income regions. More research in this area is needed, however.

The role of multinationals and FDI is not only important in terms of new technologies and new job opportunities, but also as a litmus paper of a country's openness and a fit entrepreneurial environment. An ideal environment is balanced through the fast, learning-by-doing capabilities of its inhabitants and continuous institutional change (formal rules and laws). In this setting multinationals are simply entrepreneurs. They seek profit and offer new products on the market. They are not somehow protected against global tendencies and economic fluctuations of the host economy.

References

1. Acs, Z. J., Braunerhjelm, P., Audretsch, D. B., & Carlsson, B. (2009). The Knowledge Spillover Theory of Entrepreneurship. *Small Business Economics*, 32(1), 15–30.
2. Arellano, M. (1987) . Computing robust standard errors for within-groups estimators. *Oxford Bulletin of Economics and Statistics* 49: 431–434.
3. Arellano, M. (1993) . On the testing of correlated effects with panel data. *Journal of Econometrics*, Vol. 59, Nos. 1-2, pp. 87-97.

4. Arrow, K. (1962). Economic Welfare and the Allocation of Resources for Invention. In R. R. Nelson (Ed.), *The Rate and Direction of Inventive Activity: Economic and Social Factors* (s. 609–626). Princeton: Princeton University Press.
5. Bloom, N., Sadun, R., & Reenen, J. V. (2007). *Americans Do I.T. Better: US Multinationals and the Productivity Miracle* (Working Paper No. 13085). National Bureau of Economic Research. Dostupné z <http://www.nber.org/papers/w13085>
6. Boettke, Peter J.; Coyne, Christopher J. (2003): Entrepreneurship and Development: Cause or Consequence?, *Advances in Austrian Economics*, No. 6, pp. 67-88,
7. Boudreaux, Donald J.; Holcombe, Randall G. (1989): The Coasian and Knightian Theories of the Firm, *Managerial and Decision Economics*, Vol. 10, No. 2., pp. 147-154
8. Cohen, W. M., Nelson, R. R., & Walsh, J. P. (2000). *Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not)* (Working Paper No. 7552). National Bureau of Economic Research. Dostupné z <http://www.nber.org/papers/w7552>
9. Crepon, B., Duguet, E., & Mairessec, J. (1998). Research, Innovation And Productivity: An Econometric Analysis At The Firm Level. *Economics of Innovation and New Technology*, 7(2), 115–158. doi:10.1080/10438599800000031
10. CZSO. (2012). Vliv zahraničních firem v České republice. Press release. Dostupné 27. listopad 2013, z http://www.czso.cz/csu/tz.nsf/i/vliv_zahranicnich_firem_v_ceske_republice20120119
11. Djankov, S., & Hoekman, B. (1998). *Avenues of Technology Transfer: Foreign Investment and Productivity Change in the Czech Republic* (CEPR Discussion Paper No. 1883). C.E.P.R. Discussion Papers. Dostupné z <http://ideas.repec.org/p/cpr/ceprdp/1883.html>
12. Efron, B. (1979). Bootstrap methods: Another look at the jackknife. *Annals of Statistics* 7: 1–26.
13. Fajgelbaum, P. D., Grossman, G. M., & Helpman, E. (2011). *A Linder Hypothesis for Foreign Direct Investment* (Working Paper No. 17550). National Bureau of Economic Research. Dostupné z <http://www.nber.org/papers/w17550>
14. Hashi, I., & Stojcic, N. (2010). *The Impact of Innovation Activities on Firm Performance Using a Multi-Stage Model: Evidence from the Community Innovation Survey 4* (Working Paper No. 410/2010). Warsaw: CASE. Dostupné z http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1680935
15. Hausman, J. A. (1978) . Specification tests in econometrics. *Econometrica* 46: 1251–1271.
16. Johansen, S. 1995. Likelihood-Based Inference in Cointegrated Vector Autoregressive Models. Oxford: Oxford University Press.
17. Johnson, S. R., and Gordon C. Rausser. (1971). Effects of Misspecifications of Log-Linear Functions when Sample Values are Zero or Negative. *American Journal of Agricultural Economics* 53(1):120-124.
18. Kirzner, Israel M. (1997): Entrepreneurial Discovery and the Competitive Market Process: An Austrian Approach, *Journal of Economic Literature*, Vol. 35, No. 1 (March), pp. 60-85
19. Kwok, C. C. Y., & Tadesse, S. (2006). The MNC as an Agent of Change for Host-Country Institutions: FDI and Corruption. *Journal of International Business Studies*, 37(6), 767–785.
20. Manzano, O., & Monaldi, F. (2009). The Political Economy of Oil Production in Latin America. *Economía*, 9(1), 59–98. doi:10.1353/eco.0.0018
21. Schwarz, J., Bartoň, P., Bolcha, P., Heřmanský, P., & Mach, P. (2007). Analýza investičních pobídek v České republice. Faculty of Economics at University of Economics, Prague. Dostupné z <http://www.mpo.cz/dokument34235.html>
22. Scotchmer, S. (2004). *Innovation and Incentives*. MIT Press.
23. Srholec, M. (2005). *Innovation Strategies of Multinationals: Firm-level evidence from foreign affiliates in the Czech Republic* (Working Paper). Oslo: EIBA - European International Business Academy. Dostupné z http://folk.uio.no/martinsr/pdf/0512_EIBA_Srholec_CDrom.pdf
24. Van Beveren, I. (2012). Total Factor Productivity Estimation: A Practical Review. *Journal of Economic Surveys*, 26(1), 98–128.

25. Zemplerová, A. (2004). The importance of foreign-owned enterprises in the catching-up process. In K. Liebscher, J. Christi, P. Mooslechner, & D. Ritzberger-Gruenwald (Ed.), *The Economic Potential of a Larger Europe*. Cheltenham: Edward Elgar Pub.
26. Zemplerová, A. (2006). Efekty státní podpory podniků [Effects Of State Aid To Enterprises]. *Politická ekonomie*, 2006(2), 204–213.
27. Zemplerová, A., & Hromádková, E. (2012). Determinants of Firm Innovation. *Prague Economic Papers*, 2012(4), 487–503.

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