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Productivity of Czech logistic firms: quality orientation, entrants and multinationals[1]

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Abstract

The paper analyses logistics industry in Czech Republic and analyzes clusters and groups of one hundred companies that were active in the market in 2014. Analysis is based on the economic theory of endogenous growth and technological spillovers of multinational firms. They have the know-how and technology, which makes them more productive than local firms which tries to catch up the leaders and try to get as much knowledge as possible. This paper contributes to this theory. Key findings for this transitional economy is that quality certification is not beneficial for labor productivity and earnings, there are differences among multinational firms in terms of output efficiency and they are on average more productive than local firms, older firms are less productive than younger, but entrants are not more profitable than older firms.

Key words

multinationals, certificates, convergence, entrants, logistics

JEL Classification: O30, O40

Introduction

The paper analyses logistic firms in the Czech economy in 2014 and tests hypotheses about endogenous growth theories. Logistic firms are important in transferring data, information, and knowledge between businesses and they are essential part of the technological spillovers network. This paper explores this rather unique industry and its total factor productivity measured by sales per employee. Groups of firms in the market with certain characteristics like certification, ownership, and age are analysed. Usually, as economic theory predicts, foreign firms have the knowhow and technology that makes them more efficient. We can say that they have the competitive advantage, which allows them to gain higher earnings and appropriate more from their innovations which they brought form their home country. Local firms are so called imitators and try to catch up the leaders (they bring innovations new to the regional market) and innovate (they invest in innovation new to the firm) and try to get as much knowledge as possible. To do that they, for example, standardize their processes using ISO certificates, spend more on research and development etc. There are also so-called spin-off firms, young

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companies, which are using modern information and communication technology and usually rather higher risk market strategies.

This paper explores and tests hypotheses about those technological and business model differences between certain groups of logistic firms in the Czech Republic in 2014. These hypotheses are built upon the endogenous growth theory, which emerged in the 1980s [Lucas 1988] as the neoclassical economic theory and became an innovative milestone of mainstream economics. Since then, many approaches [Nelson 1982, Dopfer 2005] implement microeconomic concepts, behavioural concepts, and more interestingly historical context [Greasley and Oxley 2011]. They aim at the complexity of economic activities [Liebowitz and Margolis 1995], analysis of social capital, and benefits of networks. These theories are broadly tested at the firm level, in organizations [Griliches 1992] where information and knowledge are amplified.

In the logistics industry, major changes occurred since 1990s because of the boom of the Internet and fast development in information and communication technology. The Global Value Chain companies are networks dependent on efficient logistics [Memedovic et al. 2008] and old methods [Stabler 1996] as well as new methods [Qureshi, Kumar and Kumar 2007] are employed to provide direct assistance and high-quality services. To do that practices of Total Quality Management and efficient Just in Time management must be employed. The main goal in logistics is to set up long-term contracted relationships and create formal and informal netwroks where information and knowledge flows have significant effects on productivity of participating companies [Prajogo and Olhager 2012].

Collaboration and networks where information and knowledge flows is thus also possible thanks to the logistic industry. It is not a coincidence that many so-called pull factors (information sources) and push factors (strategy, technology, society needs) of innovation originate in this industry [Gregory 2009]. The logistic industry enables flows of information and knowledge. On average, these strategic information flows positively impact management of assets, costs of operations, and productivity [Klein and Rai 2009]. These flows are also called spill-overs [Acs at al. 2009] that can be based on more information and knowledge flows in the logistics industry. The final technology or innovation incentive is a mixture of innovation push and pull factors, which are on the market. Foreign direct investments are one of the factors of technological change. It is not an exclusivity of former state planned economies like the Czech Republic but in transitional economies the positive productivity spillovers from foreign direct investment are stronger [Javorcik 2004] and small and entrant firms with low productivity benefit from multinational presence [Keller and Yeaple 2009].

This paper is aimed at three groups of logistic firms in the Czech economy. First group are multinationals, which have the know-how and technology. They are more efficient (managerial experience) and equipped (ICT) than local firms that are called imitators and try to catch up the leaders. Usually local firms are then seen as innovators because they are introducing new-to-the-firm innovations and sometimes new to the regional market innovations as well. They are pushed by new technologies and pulled to innovate by their clients and they invest in innovation projects and try to get as much knowledge as possible. We expect foreign firms to have higher sales [Vokoun 2014, Vokoun 2015] and their contribution to technological spillovers [Cantwell and Piscitello 2002].

Our second group of young firms in logistics industry deals with competition pressures. Relatively younger firms are usually some kind of spin-offs and we can expect them to be know-how and technologically well-equipped. In our sample, they are firms that were established in 2010 and are at most six years old. The selection of 6 years was based on practical reasons, i.e. on the number of observations necessary to estimate unbiased differences between groups of companies. We expect younger firms to be more cost efficient because the entrepreneurs could gain experience from spillovers in the transformation period of Czech economy.

The third group aims at quality management and targets premium services. To do that they standardize their processes using international certificates (at least ISO 9001). Many papers concluded that quality certifications help improve the management of logistics processes [Munuzuri et al. 2013] and on average ISO adopters had higher growth rates for sales [Levine and Toffel 2010]. In logistics however, there is a dilemma, which makes this quality adoption strategy problematic. Many whole trade and manufacturing firms are deciding to outsource logistics services. The decision to select a provider is based on quality, time efficiency and mostly on costs. Many seek high quality, low cost time efficient solutions but as always only two criteria are satisfied, which makes this dilemma an issue. For the logistics industry, there are results suggesting long-term positive effects on financial performance for logistics providers, which adopted quality certificates [Gotzamani, Longinidis and Vouzas 2010] but the productivity issue and comparison to lower quality competition is still unresolved. This is because a lot of companies have their processes already at a very high level of capability and they are unwilling to pay for probably unnecessary certification.

Current research is aimed at precise case studies of small sample of firms [Park and Lee 2015] and rather than productivity, we can see data envelopment analyses aimed at technical or operational efficiency [Min and Jong 2006] or sustainable financial health [Vochozka, Straková and Váchal 2015]. This paper makes use of rather basic econometric methods to evaluate three hypotheses about certain group differences in logistics industry in the Czech Republic in 2014.

1 Materials and Methods

Our data comes from the Business database provided by MagnusWeb, which is a representative database especially for the year 2014 in comparison to other commercial database products. There are 100 observations of firms in the logistics industry (NACE 52), and firms with empty observations in sales and fixed assets, firms with zero employees, 1 firm in the process of liquidation and one firm in the insolvency were deleted (Table 1). On average, there are 28 % foreign owned firms (more than 50% share in the company). There are young firms as well as firms established after the fall of Communism in 1989. The average firm is around 12 years old, but the standard deviation (6 years) is high and indicating high share of entrant firms and traditional companies. Other financial indicators vary a lot, especially earnings and sales from goods and services, and we can observe heteroscedastic data sample.

Table 1 Summary statistics of logistic firms in the Czech Republic in 2014

Variable	Mean	Std. Dev.	Min	Max
Firm's age	11.58	6.18	2	25
Number of employees	87.74	179.00	1	910
Foreign ownership	0.28	0.45	0	1
Certificate ISO 9001	0.20	0.40	0	1
Fixed assets	2.85e+08	1.65e+09	12000	1.53e+10
Sales	1.90e+08	3.98e+08	798000	2.59e+09
Earnings before tax	2.15e+07	1.20e+08	-4.33e+07	1.08e+09

Source: MagnusWeb database

A standard function (Equation 1) model was used for the production analysis [25]. The estimation is based on standard ordinary least square (OLS) method. Because of heteroscedasticity, the robust standard error is used to correct for estimation bias of beta coefficients. To test the specification of the model the Ramsey Reset test [Ramsey 1969] is used and the F statistics is reported. Because of the dummies in the estimation the baseline firm is a national firm without ISO certificates.

$$y_i = \omega \cdot X_i + \delta \cdot Controls_i + \upsilon_i \quad (1)$$

In the Equation 1 the $\omega \cdot X_i$ represents the vector of usual components of the production function (long term assets, number of employees), the expression $\delta \cdot Controls_i$ is a vector of control variables (ownership, age, and certification) that augments the total factor productivity function y, and υ_i is the error term. The Cobb-Douglas function requires logarithmic transformation and there is known limitation of this approach, for example the assumption of near perfect competition in the production factor markets. Problem is in assumption of non-existent endogeneity between sales and assets which can be corrected using a different production function specification.

This cross-sectional data sample (Table 1) is analyzed and sales and sales per employee are estimated. The use of standard unpaired t-test would offer biased results because the data are not normally distributed. The two sample equality hypotheses were therefore tested by the non-parametric Wilcoxon rank-sum test [Wilcoxon 1945]. It is an unmatched data equality test of two independent variables: X_1 (for example the group of entrants) and X2 (the firm's revenues).

The rank-sum test is reflected in the single Wilcoxon statistics, which tests the null hypothesis of equality on a sample of n observations. The probability of Type I error was chosen to be α=10 % ($p < 0.1$). The arithmetic mean difference between the observed groups is used as an approximation of dissimilarities under ceteris paribus condition (variable interactions were not allowed).

2 Results

Regression results suggest that there are differences between selected groups of Czech logistic firms (Table 2). The younger firms are more efficient and have higher

sales and labor productivity (sales per employee) than older firms. This productivity difference is approximately minus 4.1 % in comparison to a one-year younger firm. This is to some extend in line with economic theory and pressures of market mechanism, competition and theory of spillovers. There is possible overestimation bias. It is because in our sample there are only active firms, which are not facing bankruptcy or insolvency issues.

According to economic theories of endogenous growth, multinationals are bearers of technological progress especially in the developing markets. We can observe higher (plus 56.8 %, beta is 0.45*) productivity of foreign owned firms in comparison to base line local firms in the Czech Republic. But there is a high variability and heteroscedasticity in the results. Finally, the firms' orientation at quality (ISO certification) is not reflected in higher productivity or amount of sales in comparison to firms without certificates.

Table 2 Results of the production function in the logistics industry in the Czech Republic in 2014

Total factor productivity	(1) Sales	(2) Productivity
Number of employees (LN)	0.707***	-0.191***
	(0.08)	(0.07)
Fixed assets (LN)	0.102**	
	(0.05)	
Quality certificate (ISO 9001)	0.431	0.431
	(0.29)	(0.29)
Firm's age (years)	-0.041***	-0.041***
	(0.01)	(0.01)
Foreign ownership (>50%)	0.450*	0.450*
	(0.23)	(0.23)
Fixed assets per employee (LN)		0.102**
		(0.05)
Constant term	14.178***	14.178***
	(0.70)	(0.70)
Number of observations	100	100
Adjusted R^2	0.670	0.180
Ramsey RESET test	F=1.30	F=1.99

Note: Robust standard errors in parentheses, * p < 0.10, ** p < 0.05, *** p < 0.01

3 Discussion

This analysis has its limitations and a panel of logistic firms would be better at capturing within firm variation, which would describe the situation in longer period. In this paper, the robustness of results is tested using ANOVA and different dependent variable that is standard profit indicator earnings before taxes (EBT).

The results are not completely in line with current empirical research in the logistics industry [Park and Lee 2015, Min and Jong 2006]. The dilemma of quality, time and costs is amplified in the Czech Republic, which is an economy in the center of Europe and is one of the strategic countries for logistics industry. The quality orientation hypothesis is rejected. This strategy is not a strategy of higher productivity or profit. This strategy seems to be more long-term and socially responsible oriented. The EBT differences between national and multinational companies are substantial. National firms have on average 63.4 million CZK lower EBT than foreign owned firms. But we can observe higher variability inside foreign owned firms. This result suggests that there are certain characteristics of multinational firms that we are missing like market orientation or local competition.

Table 3 Earnings differences in the logistics industry in the Czech Republic in 2014

Group	Observations	Means
Without ISO	80	2.37e+07
ISO	20	1.27e+07
z=-2.654***	Difference	-1.10e+07
Group	Observations	means
National	72	3755889
Multinational	28	6.72e+07
z=-1.869*	Difference	-6.34e+07
Group	Observations	means
Older (7+)	72	2.26e+07
Entrants (1-6)	28	1.91e+07
z=1.539	Difference	3528764

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The analysis of differences suggests that entrant firms are not more efficient. The difference in EBT is relatively small. But we should perform more detailed technical input output efficiency analysis to account for possible cost structure of relatively younger firms.

Conclusion

This paper contributes to the theory of technological spillovers and endogenous growth. The results of logistics industry indicate that technological differences according to economic theory are to some extent present. But in this transitional economy we can observe the quality dilemma. The ISO 9001 quality certification is not beneficial for labor productivity and earnings. This result is contra intuitive and suggests high competitive pressures to lower costs. The demand in this economy is thanks to the location in the central Europe very high. The certification is suitable for this industry but is not demanded.

There are also some differences within the sample of multinational firms in terms of output efficiency (high variability and large estimation error) and they are on average more productive than local firms in the Czech Republic. Older firms are less productive than younger ones, but another analysis suggests that entrants are not more profitable than older firms. This suggests the ability to enter the market and survive with the ability to appropriate the gains from initial investment. In other words, startup costs are reducing earnings before taxes but the firm can take over a substantial market share. The logistics industry is a net of connected companies that is essential for technological transfer; multinational firms are leaders that influence the market and its technological level.

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