

# ENTREPRENEURIAL ACTIVITY IN THE CZECH REGIONS: ARE BUSINESS COMPANIES AND SELF-EMPLOYED INDIVIDUALS AFFECTED BY THE SAME FACTORS?

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## Abstract

Previous research found a positive relationship between the total entrepreneurial activity, unemployment rate and real GDP per capita in the Czech regions. In this paper, we separated business companies and self-employed individuals and calculated rate of business companies and self-employed individuals per 15-64 aged inhabitants as dependent variables. Obtained data from the Czech Statistical Office covering 14 Czech regions over years 1995-2013. As for methods, regression analysis with fixed effects and Granger Causality test were used. Results confirmed positive relationship between dependent variables and unemployment rate, real GDP per capita and R&D institutions as supporting infrastructure. Higher population density led to increase only in the case of business companies, whereas self-employed individuals were affected by higher population density negatively. More densely populated areas may require more ambitious businesses that are more frequently started by an entrepreneurial team and not by solo entrepreneurs. Finally, Granger Causality tests confirmed double-sided relationship for both types of entrepreneurial activity with real GDP per capita.

**Key words:** Entrepreneurial activity in the Czech regions, Business companies, Self-employed, GDP per capita, Unemployment rate

**JEL Code:** M2, M1, L260

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## Introduction

Recently, there was an increase in the amount of studies focused on analysis of determinants of entrepreneurship (Cueto et al., 2015 or Fritsch et al., 2015), perceived as a source of competitiveness and economic growth (Polok et al., 2016). However not many of them aim at studying regional entrepreneurial activity and most of them analyse entrepreneurship on country level or cross-country level (Leitão et al., 2011). One of the most common reasons for that is lack of longitudinal and reliable data on regional level. In the Czech Republic the

situation is very similar, data from Global Entrepreneurship Monitor (2014), presented in report written by Lukeš et al. (2014), show that in 2013 on average 5.26% of 18-64 population were involved in ownership or management of established business activity, however, data for Czech regions are still not reliable and sufficient for empirical analysis. Data from population surveys scholars usually substitute by administrative data containing amount of registered enterprises. Koellinger and Thurik (2012) mention two limitations when following this approach, firstly, registered business activity does not include nascent entrepreneurs and secondly, registered entrepreneurial activity may contain enterprises that are no longer active.

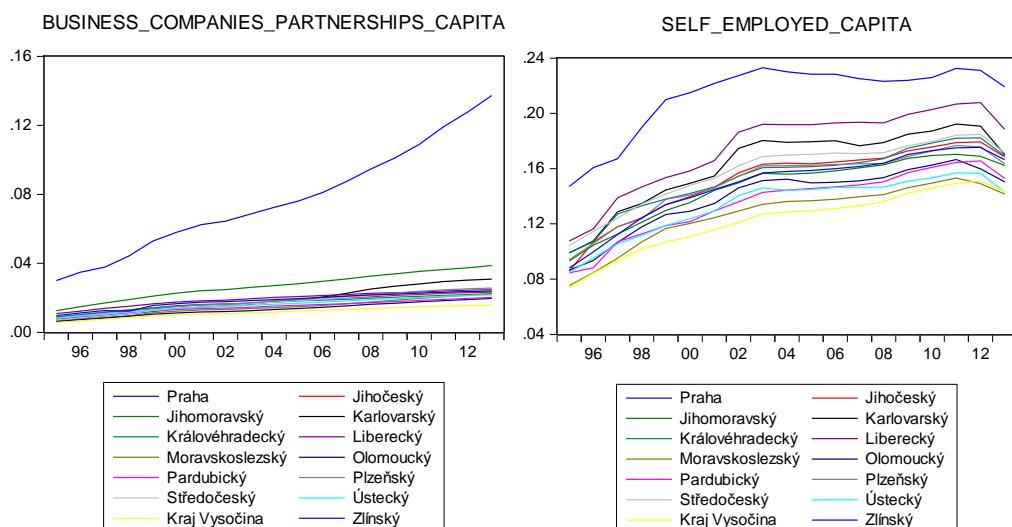
One of the recent attempts to analyse registered business activity in the Czech Republic has been done by Menčlová (2014) who did not use econometric approach (fixed effects regressions with Granger Causality tests employed by other researchers), but conducted bivariate correlation analysis between unemployment rate, GDP per capita and registered business activity for the Czech Republic. Building upon her contribution, Dvouletý and Mareš (2015, 2016) conducted a study investigating determinants of total registered entrepreneurial activity in fourteen Czech regions during years 1995-2013, using econometric approach. They have found statistically significant positive impact of unemployment rate, real GDP per capita, distribution of R&D institutions and population density on rate of registered businesses expressed as a ratio of all registered businesses and inhabitants aged 15-64 years. They worked with total entrepreneurial activity, making no difference between business companies and self-employed individuals. Both types of entrepreneurship have its specifics and therefore we dedicate this paper to answering research question whether there is any difference in determinants of rates of business companies and self-employed per inhabitant aged 15-64 years in Czech regions during years 1995-2013. Formally we state also following three hypothesis:

- **H<sub>1</sub>:** The higher level of GDP per capita is associated with higher level of both types of entrepreneurial activity up to two years lag.
- **H<sub>2</sub>:** The higher unemployment rate is associated with higher level of both types of entrepreneurial activity up to two years lag.
- **H<sub>3</sub>:** There is a double-sided relationship for both types of entrepreneurial activity with real GDP per capita in sense of Granger Causality.

## 1 Data

Collected dataset covers fourteen Czech regions for period of years 1995-2013 and variables used for analyses were obtained from various databases of the Czech Statistical Office (ČSÚ, 2015). The aim of this contribution is to analyse two types of entrepreneurial activity rate and therefore two dependent variables were calculated. The first dependent variable represents rate of business companies and partnerships per inhabitant aged 15-64 years (*BUS\_COMP\_PARTN\_CAPITA*) and the second dependent variable rate of self-employed carrying out business activities per capita (*SELF\_EMPLOYED\_CAPITA*)<sup>1</sup>. Development of both variables during period of years 1995-2013 depicts Figure 1. As we expected, the densest concentration of both types of entrepreneurial activity, can be found in Capital Praha, which could influence econometric estimations and our conclusions as the most influential region of the Czech Republic. To avoid this potential bias, all models were estimated with region Praha and also without it. No difference was found and hence Praha remained in the dataset.

**Figure 1: Entrepreneurial activity across Czech regions during 1995-2013**



Source: EViews, own elaboration

As independent variables we use Gross Domestic Product (*GDP*) per capita in Czech Crowns (*REAL\_GDP\_PER\_CAPITA*), population density (*POPULATION\_DENSITY*), percentage share of population aged 15-64 years (*SHARE\_POPULATION\_1564*), unemployment rate from labour force survey (*UNEMPLOYMENT\_RATE*), percentage share of tertiary educated population (*TERTIARY\_EDUCATION*), expenditures of business enterprises on R&D per capita in millions of Czech Crowns (*REAL\_EXP\_RD\_CAPITA*) and rate of business enterprise workplaces per thousand of inhabitants in responding units

<sup>1</sup> Czech Statistical Office (2015) uses designation “natural persons.”

(*WORKPLACES\_RD\_THINH*). Variables denominated in the Czech Crowns had to be adjusted for inflation, using Consumer Price Index (CPI) with base year 1995. And the last is dummy variable covering economic crisis during years 2008-2010 (*ECONOMIC\_CRISIS*). In Table 1 below are presented descriptive statistics of used variables.

**Tab. 1: Descriptive statistics**

Variable	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
<i>BUS_COMP_PARTN_CAPITA</i>	0.02	0.02	0.14	0.01	0.02	266
<i>SELF_EMPLOYED_CAPITA</i>	0.15	0.15	0.23	0.07	0.03	266
<i>REAL_GDP_PER_CAPITA</i>	276369.2	249999.7	766349.1	194983.4	100161.7	266
<i>POPULATION_DENSITY</i>	287.74	118.23	2533.92	62.11	597.60	265
<i>SHARE_POPULATION_1564</i>	0.70	0.70	0.72	0.67	0.01	266
<i>UNEMPLOYMENT_RATE</i>	6.71	6.32	15.97	1.90	2.87	266
<i>TERTIARY_EDUCATION</i>	10.55	10.39	21.72	4.81	2.79	266
<i>REAL_EXP_RD_CAPITA</i>	0.002	0.002	0.008	0.000	0.001	126
<i>WORKPLACES_RD_THINH</i>	0.21	0.18	0.55	0.05	0.11	126

Source: EViews, own elaboration

### 1.1 Stationarity of variables

Our dataset is structured into panel. Important assumption which has to be satisfied when working with time series and panel data, is assumption of stationarity of all variables. If assumption of stationarity is violated, biased regression estimates (spurious regressions) may occur (Verbeek, 2012). Stationarity was tested using Levin, Lin & Chu unit root test integrated in software EViews 8 in which all models were estimated. The null hypothesis states non-stationarity of the variable, by its rejection, one can accept the alternative hypothesis claiming stationarity of the variable (Levin et al., 2002). All variables were found to be stationary at least on 10% level of statistical significance.

## 2 Regression Analysis

The aim of regression analysis is to explore, whether dependent variables (rate of business companies and partnerships and rate of self-employed) are influenced by the same variables and in the same direction. Regression models were estimated with White cross-section standard errors & covariance (d.f. corrected) dealing with consequences of autocorrelation and heteroscedasticity. Unobserved heterogeneity was controlled with fixed effects estimation approach that was confirmed as the most suitable by test of redundancy of fixed effects and by Hausman test. Level of collinearity was tested by Variance Inflation Factors test and all values were below critical level of ten, therefore collinearity among independent variables is

considered as acceptable. Unfortunately, we had to reject in most of the models null hypothesis of Jarque Bera test stating normal distribution of residuals, and hence we need to interpret our results with caution (Verbeek, 2012). Models in general meet econometric assumptions, were found to be statistically significant and have good explanatory power.

## 2.1 Interpretation of Results<sup>2</sup>

In Table 2, Models 1-4 have as a dependent variable rate of business companies and partnerships and Models 5-8 have as a dependent variable rate of self-employed. Models 1 and 5 confirmed statistically significant positive impact of real GDP per capita on both types of entrepreneurial activity, supporting **H<sub>1</sub>** that in regions with higher real GDP per capita is entrepreneurial activity more concentrated. Models 1 and 5 also confirm **H<sub>2</sub>** stating that higher unemployment rate is associated with higher level of both types of entrepreneurial activity supporting our previous research findings that in times of higher unemployment rate inhabitants of Czech regions seek for new alternative (better) opportunities and become self-employed or establish new companies and partnerships. The positive coefficient was obtained for up to three years lag, however only lags one and three were found to be statistically significant. Dummy variable covering period of economic crisis during years 2008-2010 confirmed statistically significant higher level of entrepreneurial activity in comparison with other years during years.

Same direction of impact on both types of entrepreneurial activity was statistically confirmed also for variable representing share of population aged 15-64 years (negative in Models 1 and 5) and for variable representing share of tertiary educated population (positive in Models 2 and 6). Regions with more educated inhabitants are associated with higher level of entrepreneurial activity. Models 4 and 8 tested positive impact of supportive infrastructure, expressed as rate of R&D institutions, and confirmed positive influence for both types of entrepreneurial activity, concluding that supportive infrastructure through channels of networking and activities leads to increase of entrepreneurial activity.

On the other hand, positive impact of expenditures of business enterprises on R&D was confirmed only for rate of business companies and partnerships (Models 3 and 7). Another difference between both types of entrepreneurial activities was found for variable representing population density (Models 1 and 5). Higher population density led to increase only in case of business companies and partnerships, whereas self-employed individuals were

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<sup>2</sup>All variables are interpreted following formula ceteris paribus.

affected by higher population density negatively. More densely populated areas may require more ambitious businesses that are more frequently started by an entrepreneurial team and not by solo entrepreneurs.

**Tab. 2: Model table**

Variable / Model	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
<b>Dependent variable</b>	<i>BUS_COMP_PARTN_CAPITA</i>				<i>SELF_EMPLOYED_CAPITA</i>			
<i>REAL_GDP_PER_CAPITA</i>	<b>1.47E-07***</b> (2.27E-08)				<b>3.28E-07***</b> (4.37E-08)			
<i>POPULATION_DENSITY</i>	<b>0.000196***</b> (4.95E-05)	<b>0.000222***</b> (3.75E-05)	<b>0.000306***</b> (5.37E-05)	<b>0.000279***</b> (5.14E-05)	<b>-0.000279***</b> (4.48E-05)	<b>-0.000265***</b> (4.26E-05)	<b>5.45E-06</b> (2.71E-05)	<b>-4.18E-05***</b> (1.16E-05)
<i>SHARE_POPULATION_1564</i>	<b>-0.266332***</b> (0.016681)	<b>-0.127754***</b> (0.023684)			<b>-0.424955**</b> (0.184991)	<b>0.076576</b> (0.095291)		
<i>UNEMPLOYMENT_RATE</i>		<b>0.000636***</b> (0.000242)			<b>0.001951*</b> (0.001067)			
<i>UNEMPLOYMENT_RATE(-1)</i>		<b>0.000159</b> (0.000173)			<b>0.000533</b> (0.001299)			
<i>UNEMPLOYMENT_RATE(-2)</i>		<b>0.000554***</b> (0.000148)			<b>0.003021***</b> (0.001030)			
<i>ECONOMIC_CRISIS</i>		<b>0.001973***</b> (0.000775)			<b>0.015963***</b> (0.004029)			
<i>TERTIARY_EDUCATION</i>			<b>0.003753***</b> (0.000114)			<b>0.012258***</b> (0.000460)		
<i>REAL_EXP_RD_CAPITA</i>				<b>2.503367***</b> (0.971271)			<b>2.380709</b> (1.900064)	
<i>WORKPLACES_RD_THINH</i>					<b>0.078819***</b> (0.010174)			<b>0.154275***</b> (0.044092)
<i>CONSTANT</i>	<b>0.101632***</b> (0.021193)	<b>0.007312</b> (0.024481)	<b>-0.067348***</b> (0.015184)	<b>-0.070845***</b> (0.014996)	<b>0.402375***</b> (0.128049)	<b>0.044559</b> (0.066376)	<b>0.162730***</b> (0.009255)	<b>0.149101***</b> (0.009568)
<b>R-Squared</b>	0.963091	0.954806	0.972895	0.978047	0.881892	0.970284	0.929823	0.957524
<b>Adj. R-squared</b>	0.959673	0.951891	0.969165	0.975026	0.870956	0.968366	0.920166	0.951678
<b>F-statistic</b>	281.8089	327.4681	260.8278	323.7420	80.64150	506.0959	96.28092	163.8092
<b>Observations</b>	237	265	125	125	237	265	125	125

Note: Standard Errors are in parenthesis \*\*\* stat. significance on 1 %, \*\* stat. significance on 5 %, \* stat. significance on 10 %.

Source: EViews, own elaboration

### 3 Granger Causality Testing

This section is dedicated to investigation of relationship between both types of entrepreneurial activity and real GDP per capita employing Granger Causality testing. Granger causality testing was introduced by Granger (1969) and the method tests whether previous values of one variable are able to predict future values of another variable. The null hypothesis states that there is no Granger-Causality between tested variables, if the null hypothesis is rejected one is allowed to accept alternative hypothesis stating that such a relationship exists. On 5% level of statistical significance we confirm, that there is double-sided relationship for both types of entrepreneurial activity with the real GDP per capita (Table 3). We have obtained the same results when controlling for lags three and five and confirm  $H_3$  that there is a double-sided relationship for business companies and partnerships and self-employed with real GDP per capita in sense of Granger Causality.

**Tab. 3: Granger Causality between Entrepreneurial activity and Real GDP per capita**

Tested Relationship	P-value	Lags	$H_0$ Reject
<i>REAL_GDP_PER_CAPITA → BUS_COMP_PARTN_CAPITA</i>	0.0125	10	Rejected
<i>BUS_COMP_PARTN_CAPITA → REAL_GDP_PER_CAPITA</i>	5.E-16	10	Rejected
<i>REAL_GDP_PER_CAPITA → SELF_EMPLOYED_CAPITA</i>	1.E-07	10	Rejected
<i>SELF_EMPLOYED_CAPITA → REAL_GDP_PER_CAPITA</i>	1.E-05	10	Rejected

Source: EViews, own elaboration

### Conclusion

In this paper, we built upon our previous research dedicated to determinants of rate of registered business activity in the Czech regions (Dvoouletý and Mareš, 2015, 2016) and investigated whether there was any difference in the determinants of rates of business companies and self-employed per inhabitants aged 15-64 years in the Czech regions during years 1995-2013, using data from the Czech Statistical Office. As for methods, we followed econometric approach estimating regression models with fixed effects and Granger Causality tests. Our findings did not significantly differ to those, obtained when investigating total rate of registered business activity, however some differences were observed.

We were able to accept both tested hypothesis, assuming that there was a positive relationship between the real GDP per capita, unemployment rate and both types of entrepreneurial activity during the analysed period. Therefore in the regions with higher real

GDP per capita were both types of entrepreneurial activity more concentrated and that higher unemployment rate was associated with higher level of both types of entrepreneurial activity. Regression estimates also supported positive impact of supportive infrastructure on both types of entrepreneurial activity. Share of tertiary educated population confirmed positive impact on both types of entrepreneurial activity, supporting assumption, that regions with more educated inhabitants have higher level of business activity. However, positive impact of real R&D expenditures was found to be significant only for business companies. The main difference was found for variable representing population density. Higher population density led to increase of entrepreneurial activity only in case of business companies, whereas self-employed individuals were affected by higher population density negatively. More densely populated areas may require more ambitious businesses that are more frequently started by an entrepreneurial team and not by solo entrepreneurs. Finally, Granger Causality tests confirmed hypothesis assuming double-sided relationship between the both types of entrepreneurial activity and real GDP per capita in sense of Granger Causality.

According to our results, regional entrepreneurial policies should continuously support entrepreneurial activity and even more during times of higher unemployment rate, helping people to seek for new business opportunities by providing entrepreneurial trainings. For future research we welcome any initiatives conducting population surveys of entrepreneurial activity on regional level as necessary source of future deeper insight into determinants of the Czech regional entrepreneurial activity.

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