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RELATIONSHIP BETWEEN UNEMPLOYMENT AND ENTREPRENEURSHIP DYNAMICS IN THE CZECH REGIONS: A PANEL VAR APPROACH

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Abstract

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Investigation of the relationship between unemployment and entrepreneurship still does not provide conclusive results and scholars argue that the relationship needs to be further investigated. In the Czech context, the knowledge about entrepreneurship is still underdeveloped. The purpose of this paper is to investigate the dynamics of the relationship between unemployment and entrepreneurship, applying the methodology used by Koellinger and Thurik (2012) with usage of the quarterly data for the Czech NUTS 3 regions for the period of years 2003–2014. Collected sample of 672 region-quarter observations was obtained from the Czech Statistical Office. Estimated panel vector autoregressive (VAR) models with impulse response function supported hypothesis assuming a positive relationship between unemployment and entrepreneurship, operationalized as annual growth in registered business activity. Obtained results also showed that after the shock in unemployment, dynamics of entrepreneurship increased above its initial level after two years, concluding that it may take up to two years before positive effects on entrepreneurship reveal. This finding provides value for entrepreneurship policy makers. Based on the obtained results author suggests to support entrepreneurial activity, especially during the times of higher unemployment rate.

Keywords: Entrepreneurial activity, unemployment rate, necessity entrepreneurship, self-employment, Vector Autoregressions (VAR), impulse response function, the Czech NUTS 3 regions, the Czech Republic

INTRODUCTION

Scientific debate regarding the relationship between unemployment and entrepreneurship is, despite the recent increase in the amount of published studies (Dvouletý, 2017; Dvouletý and Mareš, 2016a, Cueto *et al.*, 2015, Klapper *et al.*, 2015 or Fritsch *et al.*, 2015), still not fully conclusive and scholars point out that this relationship varies over the time and across countries (Baptista and Thurik, 2007). Results of this research have clear implications for entrepreneurship policy makers, providing them tool for the decisions about the future adjustment of entrepreneurship policies during the times of higher unemployment rate.

In the Czech context, scientific knowledge about the entrepreneurship is still relatively scarce, despite the fact that entrepreneurship plays an important role in economic development of the Czech Republic, but also of the whole Central and Eastern European region (Holienka *et al.*, 2016; Polok *et al.*, 2016; Šebestová *et al.*, 2015 or Welter and Smallbone, 2011). According to the Global Entrepreneurship Monitor, on average 5.3% of adults were involved in established business activity in the Czech Republic in 2013 (Lukeš *et al.*, 2014).

Several articles investigated entrepreneurship in the Czech Republic from the micro level perspective (see, e. g. Lukeš and Zouhar, 2016, Belás *et al.*, 2015 or Strýčková, 2015), however even fewer of them aimed to study the whole population of enterprises and its development over time. One recent contribution related to the determinants of the Czech entrepreneurship has been published by Hájek *et al.* (2015) who were unable to find any statistically significant relationship between entrepreneurial activity and unemployment rate. Contrary to Dvouletý and Mareš (2016b) who found positive, statistically significant relationship between entrepreneurship and unemployment rate. Both studies work with annual data and analyse entrepreneurship statically.

The purpose of this article is to investigate dynamics of the relationship between entrepreneurship and unemployment in the Czech NUTS 3 regions using quarterly data for population of active enterprises and unemployment rate, covering the period of years 2003–2014. Empirical part of the study works with the sample of 672 region-quarter observations and monitors the fourteen Czech NUTS 3 regions for the period of 48 quarters. Empirical approach follows methodologically the study of Koellinger and Thurik (2012) who quote the words of Hoover *et al.* (2008) "let the data speak freely" and who estimated vector autoregressions with impulse response functions to analyse the dynamics of entrepreneurship and unemployment.

Next part is dedicated to the literature review, studying the previously published studies related to the relationship between entrepreneurship and unemployment. This section also describes the applied empirical approach and presents the tested hypothesis. The following part provides reader information about collected data and presents descriptive statistics of the key variables. After the dataset is introduced, reader is guided through the estimation of vector autoregressive (VAR) model. In the same section, obtained results from the impulse response function are discussed. Finally, recommendations for future research and policy implications can be found in conclusion.

Unemployment and Entrepreneurship

Ambiguity of the relationship between unemployment and entrepreneurship is commonly explained by the researchers in the following way, discussing two effects acting against each other. Decline in the economic growth and fall of the economy into the recession is usually associated with the higher level of unemployment rate and decrease in salaries due to the overall drop of aggregated demand, which finally results in the decrease of entrepreneurial activity (Dvouletý, 2017; Grilo and Thurik, 2004, Carree and Thurik, 2010). At the same time, decrease in salaries and wages lowers the opportunity costs for business start-up, especially for unemployed individuals, whose opportunity costs are benefits (unemployment spells) collected during the stay in unemployment. That makes from unemployed people an important source of potential entrepreneurs, since unemployment benefits are lower than the expected payoff from engagement in entrepreneurship (Parker, 2009, Congregado *et al.*, 2009). Since unemployed do not have better alternative opportunities, this kind of entrepreneurship is associated with the term necessity entrepreneurship, providing unemployed an opportunity to earn money for living, till better alternative opportunities reveal on the labour market (Carree and Thurik, 2010). Hence the total amount of newly created enterprises may exceed the number of businesses closed due to recession and result in the higher level of entrepreneurial activity. However once the economic performance turns into an economic growth, necessity entrepreneurs may withdraw from entrepreneurial activity because of the better alternative opportunities on the labour market and overall entrepreneurial activity may even decrease (Llopis *et al.*, 2015, Fotopoulos, 2014, Koellinger and Thurik, 2012)

Baptista and Thurik (2007) point out that this relationship may vary over time and across countries and needs to be empirically investigated econometrically. Potential outcomes should be monitored with up to the two year lags. Positive, pro-cyclical relationship between unemployment and entrepreneurship has been obtained recently by Fritsch *et al.* (2015). Nevertheless, Cueto *et al.* (2015) note that the positive effect on entrepreneurial activity occurs only when unemployment rate increases substantially. Koellinger and Thurik (2012) studied the dynamics of entrepreneurship and business cycle using population of registered businesses, GDP per capita and unemployment rate for 22 OECD countries over the period of years 1972–2012. To analyse the relationship, authors estimated vector autoregressive (VAR) models and constructed impulse response functions to illustrate the impact of increase in entrepreneurial activity on unemployment rate over the time. Their results confirmed that entrepreneurship leads to decline in unemployment rate and increase in economic growth.

One of the first empirical investigations of the relationship in the Czech context was conducted by Menčlová (2014) who used bivariate correlation analysis between entrepreneurship and unemployment, analysed the period of years 1992–2011. Menčlová (2014) obtained negative correlation coefficient for joint-stock companies and companies with limited liabilities, however she reported no statistically significant impact of economic recession during the years 2008–2010. More robust econometric approach was applied by Hájek *et al.* (2015) who analysed the Czech micro-regions during the period of years 2011–2012. Hájek *et al.* (2015) estimated regression models

with parameters lagged up to two years, however they were unable to find any statistically significant impact of unemployment on entrepreneurial activity. Different result was obtained by Dvouletý and Mareš (2016b) who analysed the impact of unemployment rate on entrepreneurial activity using annual data for the NUTS 3 regions for the period of years 1995–2013 and who obtained statistically significant, positive influence. This contradictory findings may be caused by the length of the analysed period. Another reason could be the fact that Hájek *et al.* (2015) did not expressed entrepreneurial activity per capita, but only in absolute numbers.

To shed more light on the dynamics of the relationship between entrepreneurship and unemployment in the Czech context I apply methodological approach of Koellinger and Thurik (2012) and I empirically estimate vector autoregressive (VAR) models with impulse response function with the purpose to analyse the dynamics of the relationship. My tested hypothesis is stated below:

H_1: There was a positive relationship between dynamics of unemployment rate and entrepreneurial activity during the period of years 2003–2014 in the Czech NUTS 3 regions.

Data

Obtained data come from the Czech Statistical Office (CZSO, 2016) and cover the 14 Czech NUTS 3 regions quarterly from the first quarter of 2003 (2003Q1) to the last quarter of 2014 (2014Q4). Collected dataset consists of 672 observations for each of the two variables, total amount of registered businesses in the region at the end of quarter (*Entrepreneurial_Activity*) and unemployment rate (*Unemployment_Rate*) in percentages. Advantage of this approach is that the period starting from 2003 is not affected by the relatively turbulent years after the establishment of the Czech Republic (90s), when the entrepreneurial activity grew rapidly. Disadvantage of this dataset is that quarterly NUTS 3 regional data do not contain any other explanatory variables, such as GDP per capita. All outputs come from the econometric software EViews 9.

Total amount of registered businesses at the end of each quarter is used as operationalization of entrepreneurial activity in the Czech regions. Limitation of this approach is that population of registered businesses covers also enterprises that are registered, but no longer active. On the other hand, registered business activity does not cover nascent entrepreneurship (Koellinger and Thurik, 2012). To solve this issue, data depicting entrepreneurial activity obtained from the population surveys such as Global Entrepreneurship Monitor would be needed. However sufficiently long time series for the Czech Republic are still unfortunately not available (GEM, 2016).

From the Tab. I presenting the descriptive statistics, can be clearly seen that on average the highest level of entrepreneurial activity was during the analysed period in the Capital region Praha, which is suspected for being an outlier. On the opposite, on average, the lowest level of entrepreneurship was reported in Karlovarsky region. On average, 180,980 registered enterprises per region at the end of quarter, were registered in the Czech Republic during the period of years 2003–2014.

Summary statistics for unemployment rate can be found in the Tab. II. As expected one can see significant differences among the Czech regions. The lowest level of unemployment rate was on average in the Capital Praha and the highest level of unemployment rate was reported in Ustecky region. Average unemployment rate was at the end

I: *Descriptive statistics for the amount of registered businesses across the Czech regions*

Region	Mean	Median	Max	Min	n
Jihocesky	151161	151991	160786	137820	48
Jihomoravsky	274323	275973	300204	242366	48
Karlovarsky	78178	76812	83797	71604	48
Kralovehradecky	128815	129851	135996	117234	48
Liberecky	113177	113681	119925	103837	48
Moravskoslezsky	237943	240794	250028	218454	48
Olomoucky	133188	134171	139552	124497	48
Pardubicky	108734	109486	116363	97117	48
Plzensky	135602	137492	148471	119532	48
Praha	476275	473504	557736.0	399030	48
Stredocesky	291040	294448	323025	248513	48
Ustecky	171315	172417	179845	157353	48
Vysocina	100901	101371	108800	92000	48
Zlinsky	133077	133185	138832	124525	48
All	180980	136754	557736	71604	672

(Source: EViews, author's elaboration, in units)

of quarter during the observed period in the Czech regions 6.9%. Overview of the both descriptive statistics indicated substantial heterogeneity across the Czech regions which could affect the estimation of econometric models.

Stationarity and seasonality

Besides the present heterogeneity over time and across the regions, one needs to deal with the two issues, connected to the empirical work with the quarterly panel. Those econometric issues are stationarity and seasonality. Stationarity condition requires for both variables to have relatively constant mean and constant variance over the time and across units, otherwise the results could provide spurious regression estimates, as pointed out by Newbold and Granger (1974). To ensure the stationarity of the variables Baltagi (2016) suggests to use unit root tests. Therefore I employ unit root test in version of Levin *et al.* (2002) integrated in EViews 9. This test assumes on the null hypothesis that the variable is non-stationary. On the 5% level of the statistical significance I was unable to reject the null hypothesis of non-stationarity for the both variables, as they are denominated in the Tabs I and II.

Seasonality present in quarterly data, could be one source of non-stationarity of the variables and therefore I follow the approach suggested by Tsay (2010) and transform the both variables into annual seasonal differences for unemployment rate expressed in percentages (*Unemployment_Growth*) and seasonal percentage changes for the variable, which represents entrepreneurial activity (*Entrepreneurship_Growth*). Interpretation of the variables in the regression analysis is hence percentage change over the same quarter of the previous year. This solution stabilizes both, mean and variance of the both variables and ensures that the results will not be affected by seasonality and non-stationarity.

Additional testing of stationarity on 5% level of the statistical significance rejected the null hypothesis of non-stationarity for both variables expressed as annual percentage change and allowed me to accept the alternative hypothesis, stating that the both variables are stationary. This result allows me to proceed towards the estimation of vector autoregressive (VAR) models.

RESULTS AND DISCUSSION

To investigate the dynamics of entrepreneurial activity and unemployment rate I estimate vector autoregressions (VAR). For the empirical estimation on the panel data, variables need to be stationary and one needs to decide about the optimal lag length according to Holtz-Eakin *et al.* (1988). Hušek (2009) suggests to use for lag selection information criteria. The impact of unemployment rate on entrepreneurship is then interpreted based on the results of the Granger causality test, testing the time dependency and the ability to forecast each of the variable (Granger, 1969), and based on the construction of impulse response function applying Choleski's decomposition (Hušek, 2009).

To ensure that the results will not be biased by the economic recession, which lasted during the period of years 2008–2010, I added to estimation exogenous dummy variable covering this period (*Crisis2008_2010*) and another dummy variable controlling for the region with the Capital – Praha (*Praha*). Regressions were also estimated without the region Praha. However excluding the region Praha from the analysis did not have any impact on the obtained results. The dummy variable representing the region Praha (*Praha*) was however kept in the estimated models, because the variable

II: *Descriptive statistics for unemployment rate across the Czech regions*

Region	Mean	Median	Max	Min	n
Jihocesky	4.90	5.12	6.89	1.93	48
Jihomoravsky	7.12	7.57	8.92	4.21	48
Karlovarsky	9.39	9.59	12.44	5.59	48
Kralovehradecky	6.15	6.06	9.48	3.17	48
Liberecky	6.96	6.76	9.90	4.13	48
Moravskoslezsky	10.69	9.85	15.50	6.81	48
Olomoucky	8.41	8.25	12.26	5.60	48
Pardubicky	6.30	6.43	9.50	3.45	48
Plzensky	5.05	5.19	7.08	3.18	48
Praha	3.16	3.28	4.54	1.73	48
Stredocesky	4.67	4.93	6.16	2.50	48
Ustecky	11.11	10.73	15.24	7.27	48
Vysocina	5.82	6.09	7.81	2.80	48
Zlinsky	7.04	7.20	10.39	3.48	48
All	6.91	6.62	15.50	1.73	672

(Source: EViews, author's elaboration, in %)

III: *Estimated VAR (8), 504 observations, standard errors are in parentheses*

Variable	Entrepreneurship_Growth	Unemployment_Growth
Entrepreneurship_Growth(–1)	1.007	0.0001
	(0.045)	(0.043)
Entrepreneurship_Growth(–2)	–0.112	0.012
	(0.064)	(0.061)
Entrepreneurship_Growth(–3)	0.033	0.004
	(0.064)	(0.061)
Entrepreneurship_Growth(–4)	–0.779	0.029
	(0.061)	(0.058)
Entrepreneurship_Growth(–5)	0.791	–0.035
	(0.070)	(0.066)
Entrepreneurship_Growth(–6)	–0.109	0.029
	(0.078)	(0.075)
Entrepreneurship_Growth(–7)	0.012	–0.019
	(0.077)	(0.073)
Entrepreneurship_Growth(–8)	–0.091	0.008
	(0.058)	(0.055)
Unemployment_Growth(–1)	–0.155	0.831
	(0.047)	(0.045)
Unemployment_Growth(–2)	0.025	0.121
	(0.062)	(0.059)
Unemployment_Growth(–3)	–0.063	–0.096
	(0.062)	(0.059)
Unemployment_Growth(–4)	0.070	–0.559
	(0.061)	(0.058)
Unemployment_Growth(–5)	0.017	0.254
	(0.060)	(0.057)
Unemployment_Growth(–6)	–0.025	0.135
	(0.062)	(0.059)
Unemployment_Growth(–7)	–0.051	–0.003
	(0.062)	(0.059)
Unemployment_Growth(–8)	0.158	–0.159
	(0.048)	(0.046)
Constant	0.066	–0.215
	(0.079)	(0.075)
Crisis2008_2010	0.544	0.391
	(0.106)	(0.101)
Praha	0.509	–0.052
	(0.172)	(0.164)
R–squared	0.796	0.753
Adj. R–squared	0.788	0.743
F–statistic	104.826	82.004

(Source: EViews, author's elaboration)

was increasing the amount of explained variance by the model without having any impact on the presented results.

Based on the described approach I have estimated model VAR (8) which was selected based on the best values of information criteria. From the econometric verification perspective I have controlled for the presence of AR roots and I also checked the correlogram of residuals. No systematic patterns were observed and no AR roots detected. Choosing specification of 8 lags, equal to two years as, is also in accordance with the previously published studies (Koellinger and Thurik, 2012). I have also estimated the control model VAR (4), which

is more parsimonious, but the model reported similar results, nevertheless the model VAR (8) was selected due to its better explanatory power. As already mentioned before, model VAR (8) reported the best values of information criteria. Estimated model satisfies condition of stability and the model is presented in the Tab. III. R-Squared (0.80) and F-statistics (104.8) related to the key equation with the dependent variable *Entrepreneurship_Growth* inform us that the model fit is good. Therefore we may proceed towards the interpretation of obtained results.

Tab. IV presents the results of the VAR (8) Granger Causality/Block Exogeneity Wald tests. On 5% level of the statistical significance I reject the null hypothesis of non-existence of the relationship between the annual percentage change of unemployment rate and entrepreneurial activity. I accept the alternative hypothesis stating that the relationship in sense of Granger causality during the analysed period existed. The relationship is further analysed through the impulse response function.

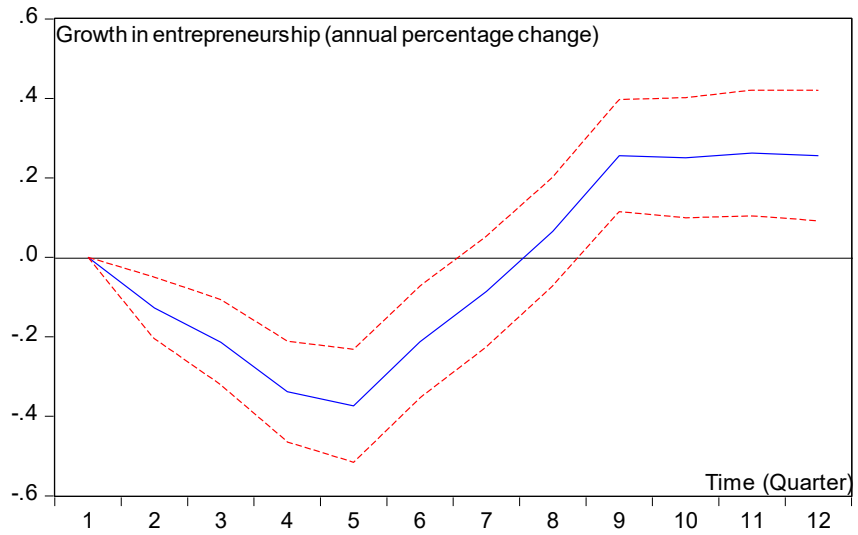
Fig. 1 presents the estimated impulse response function for the development of the dependent variable, annual percentage change of the entrepreneurship (*Entrepreneurship_Growth),* after the shock in annual percentage change in unemployment rate (*Unemployment_Growth).* Right after the increase in unemployment rate growth, the entrepreneurial activity started to decrease and reached its bottom between the fourth and fifth quarter, after which started to increase back to its initial state, reaching it by around seventh quarter. Entrepreneurial activity continued rising until it reached its peak after eight quarters and resulted in higher level of entrepreneurship growth compared to its initial state. Finally, after the twelve quarters the shock slowly disappeared.Estimated impulse response function shows that two years after the unemployment shock, the growth in the amount of new enterprises exceeds the shutdown of established enterprises and results in the higher level of entrepreneurial activity compared to its initial state, which is a supportive argument for the stated $\mathbf{H_1}$ assuming a positive relationship between unemployment and entrepreneurship dynamics during the analysed period of years 2003–2014. Obtained findings are also in consensus with the results reported previously by Dvouletý and Mareš (2016b). However it looks like that the positive response of entrepreneurship dynamics is not that fast and that it takes about two years for entrepreneurial activity to growth above its initial level after the increase in unemployment rate.

This finding can be supported by the results obtained by Belás *et al.* (2015) who argue that the most important motive for starting a business in the Czech Republic was to have a job. Results obtained by Hájek *et al.* (2015) may be different due to investigation of the relatively short period of time, covering only years 2011–2012. Perhaps enlargement of their dataset by additional years would bring positive relationship between

IV: *VAR (8) Granger Causality/Block Exogeneity Wald Tests*

variable	Chi-sq	p-value	h_0 reject
Unemployment_Growth	55.24371	0.00	Rejected
All	55.24371	0.00	Rejected

(Source: EViews, author's elaboration)



1: *Response of Entrepreneurship_Growth to Cholesky one s. d. Unemployment_Growth innovation*
(Source: EViews, author's elaboration)

entrepreneurship and unemployment too. Authors should also work with the data, which are comparable across the Czech regions, and hence apply transformation into percentage changes, or authors should calculate entrepreneurial activity per capita or per economically active inhabitant, as it is usually done by entrepreneurship scholars (see e. g. Fritsch *et al.*, 2015, Berkowitz and DeJong, 2005) or in the methodology of Global Entrepreneurship Monitor (GEM, 2016).

CONCLUSION

Presented article aimed to investigate the dynamics of unemployment rate and entrepreneurial activity in the Czech NUTS 3 regions over the period of years 2003–2014 using quarterly data. Empirical part of the article applied methodology used by Koellinger and Thurik (2012) and estimated vector autoregressive (VAR) models with the construction of impulse response function. Obtained results revealed the dynamics between unemployment and entrepreneurship, supporting arguments regarding the presence of necessity entrepreneurship in the Czech regions. However it took up to two years for entrepreneurship growth to increase above its initial level and therefore the positive response of entrepreneurship towards an economic decline takes in the Czech Republic some time.

Based on obtained findings, entrepreneurial activity increases above its initial state, two years after the shock in unemployment rate. Entrepreneurship policy makers should discuss the alternative to support individuals struggling with an engagement into entrepreneurship, particularly prepare set of actions, guiding potential entrepreneurs through the process of business start-up and therefore to speed up the process of founding enterprises which could lead to acceleration of the total increase in entrepreneurial activity with all its positive externalities. Therefore I advise policy makers who are responsible for entrepreneurship policies to put more effort into the support of entrepreneurship in the Czech Republic, especially during the times of higher unemployment rate. Importance of the need to focus entrepreneurship policies on unemployed has already been pointed out by the previous researchers (e. g. Lukeš *et al.*, 2014, Dvouletý and Lukeš, 2016 or Dvouletý and Mareš, 2016b), who suggest to support entrepreneurship through the organization of trainings, workshops and allocation of the resources towards entrepreneurial infrastructure (e. g. science parks and business incubators). Other initiatives supporting monitoring of entrepreneurial activity on the regional level, such as Global Entrepreneurship Monitor (GEM), are needed for robustness check of obtained results. One extension on the presented article perceived as a challenge for future research is to estimate separate econometric models for different forms of entrepreneurial activity, e. g. self-employment and business companies and to investigate their dynamics with the business cycle (Dvouletý and Mareš, 2016c). Future research in the Czech Republic needs to also address the impacts of entrepreneurship policies and to evaluate their effectivity and influence on the new business formation (Dvouletý and Lukeš, 2016; Mirošník *et al.*, 2016 or Blažková, 2016).

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