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Economic analysis and spatial arrangements of engineering SMEs performance in Olomouc region of Czech Republic

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Abstract. The aim of this paper is to describe SMEs performance on the regional level with respect to their geographical location. As there is no such research on the regional level, we calculate and describe traditional indicators of performance, financial position and changes in the financial position represented by ROE, Financial Leverage and Cash Flow on Sales. These indicators are then compared with the results of previous research which has been conducted on Eastern Europe and also spatially projected on the map to demonstrate spatial distribution of companies' performance. Our findings from the observation of 170 SMEs allow us compare the regional level of financial indicators with the European one, and our findings suggest that the Olomoucký region is weaker.

Keywords: financial indicators, spatial distribution, engineering small and medium enterprises, profitability.

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INTRODUCTION

The aim of this paper is to analyze the situation, dynamics and spatial distribution of small and medium-sized enterprises (SME) from the regional perspective. SMEs are vital and crucial part of national and regional economies. The role of SMEs is quite well researched and documented, as demonstrated by several studies (Nicolau, 2015), (Dixit, & Kumar, 2011) or (Maria, Spulbar, & Buziernescu, 2008) and others. According to the Czech Statistical Office (CZSO, 2013), their share in GDP of Czech Republic is around 32%, and they provide around 50% of all jobs. It is still lower than e.g. in Germany, where SMEs generate around 50% of GDP and provide 70% of jobs. Other important factors, which underpin the significance of SMEs are their fast response to new market conditions, and high absorption rate of employees (CZSO, 2007). So the main aim is to explore and analyze the regional approach and put it into the international context.

THEORETICAL FRAMEWORK

Small and medium-sized enterprises (SMEs) may be understood differently in various economies and various national context. An elementary difference why SMEs have not been understood in a common way, lies in the fact that even legislation has not yet set uniform rules, e. g., in assessing their size (Vojík, 2010). That is the reason for the non-existence of any comprehensive, generally accepted definition of small and medium-sized enterprises and the number of employees is usually the common criterion for defining small and medium-sized business. The European Union characterizes small and medium-sized enterprises on the basis of three primary criteria (Commission of the European Communities, 2001): (1) the number of employees, (2) economic independence (a company is independent if 25% or more of its net worth or voting rights is not owned by another company or a group of companies), and (3) annual turnover of a company (or book value of the total balance sheet). Legislative changes in Czech Republic valid since 1st January 2016 have touched all business units in the following way:

1. Micro accounting unit - employs less than ten employees, the annual turnover does not exceed CZK 18 million (0.67mln EUR), the annual balance sheet total does not exceed CZK 9 million (0.33 mln EUR).
2. Small accounting unit - employs less than 50 employees, the annual turnover does not exceed CZK 100 million (3.7 mln EUR), or the annual balance sheet total does not exceed CZK 200 million (7.4 mln EUR).
3. Medium accounting unit - between 50 and 250 employees, the annual turnover does not exceed CZK 500 million (18.5 mln EUR), or the annual balance sheet total does not exceed CZK 1 000 million (37 mln EUR).

As the main method will be used various measures of performance, to observe the financial impact of SMEs on regional economy, there are various methods or sets of indicators how to quantify efficiency and performance of various activities in the company. There are quite many papers on this topic, including those by Czech authors, e.g. Wagner (2011), focusing on the development during the 20th century and briefly explaining, why traditional measures based on profit are criticized. Petera and Wagner (2015) explain (*inter alia*) that for long-term sustainability also other aspects (such as vision) are crucial. Among non-Czech authors, (Dechow, 1994) was exploring advantages and disadvantages of measures based on accruals as compared to cash-based measures. We used traditional measures because there is data available and also because (Kocmanová, 2010) this traditional approach to evaluating business performance based on standard profitability ratios still prevails in Czech Republic.

Critical evaluation of business performance is usually focusing on financial and economic performance. According to Voudis et al. (2011), this does not lead to long-term success of a company, and therefore these authors defined the following tools for corporate performance measurement: Balanced Scorecard, Excellence Model, ISO 9001, Six Sigma, etc. The same has been confirmed by (Pawliczek et al., 2012) who grounded the use of ISO 9000 and ISO 14000 management systems as sophisticated contemporary management tools.

METHODS

As has been stated before, the primary objective of this research is to observe, describe and analyze a spatial distribution of economic performance measures of SMEs. Taking into consideration the aim of this research, a short-term research of the primary information of descriptive character was chosen. A documentary analysis of the data was carried out. The data was obtained from a database accessible through the website portal www.justice.cz which is administered by the company Telefónica O2 Business Solutions for the Ministry of Justice. These data are available six months after the end of a period (for example data from 2010 are available on July 2011) and usually are presented as scanned documents in PDF form, taken from the annual accounting reports. Therefore these data has to be collected manually by a transcription. These data collection lasted 18 months using MS Excel. After we finished the primary data collection, we also extended our database by acquiring additional data (related to the qualitative characteristic). These additional data was obtained from the websites of companies (from their balance sheets and profit/loss statements) and official lists and directories of the Czech Statistical Office. Based on these steps, we created a database of more than 1,200 companies. This (tedious) process is the main reason why the available data are from 2008 to 2012. The data used in this research represents subset of the database, i.e. 170 engineering SME companies that fit our criteria according to the CZ-NACE classification. After the adjustment for extreme values (Grubbs test for outliers), we finally obtained 136 business entities which were suitable for the research.

Indicators examined the performance of selected industrial SMEs for the five-year period (2008-2012). The research sample was structured according to the CZ-NACE into three groups – (1) manufacturing industry, (2) production and distribution of electricity, gas, heat, and (3) transportation and storage. From financial analysis and their selected three basic key performance indicators were used for measuring and assessment of the performance of industrial enterprises: return on equity, financial leverage and cash flow to sales. In that context, the comparison of obtained results was carried out in the surveyed period as well as the determination of trends in business by the surveyed industrial SMEs.

Relevant indicators obtained from standard accounting reports (balance sheet, profit and loss statement, cash flow statement) of business entities are economic indicators characterizing individual industrial enterprises:

1. Return on equity (ROE) which measures the return on capital that is invested into the enterprise by owners, in the paper labeled as ROE_C for manufacturing industry, ROE_D production and distribution of electricity, gas, heat and ROE_H transportation and storage.
2. Financial leverage (FINLev) which evaluates the benefits of debt financing, i.e. testifies whether there is a sort of influence of the leverage between return on equity (ROE) and return on assets (ROA), in the paper financial leverage for manufacturing industry is marked as $FINLev_C$, $FINLev_D$ production and distribution of electricity, gas, heat and $FINLev_H$ transportation and storage.

3. Cash flow on sales (CFonSale). The indicator cash flow (CF) is influenced by some economic factors, and it is an absolute indicator. The sales indicator was chosen because it has a significant impact on the market economy and CFS characterizes internal financial capabilities of a company. In the paper, it is marked as CFonSale_C for the manufacturing industry, CFonSale_D production, and distribution of electricity, gas, heat and CFonSale_H transportation and storage.

From a methodological point of view, the research had the following sequence: data collection, which took the most time, data adjustment (verification, dropping the redundancies, etc.), and structuring companies by CZ-NACE into sections (C – manufacturing industry, D – production and distribution of electricity, gas, heat, and H – transportation and storage). Subsequently, we obtained quantitative data of industrial enterprises which have been processed by using a tool of financial analysis in the form of financial ratios determining the economic performance of enterprises. To avoid the impact of extreme values, we applied the Grubbs test for outliers based upon standardized Z-score calculated for the ROE, FINLev, and CFonSale. Extreme values were neglected in our calculation of the descriptive indicators. Based on these cleaned data, the descriptive analysis was applied. Most indicators are focused on the level and variability, we calculated and analyzed the data using mean, median, maximum, minimum, deciles, etc. The qualitative data acquired in primary research were evaluated using Microsoft Office Excel, IBM SPSS 19 statistical software and methods of analysis, synthesis, induction, description and comparison. All maps were prepared in the ArcGIS for Desktop 10.x software tools.

RESULTS

We received the statistics as shown in Table 1, indicators calculated for the CZ-NACE C, D and H sections are labeled. The final number of valid observations is also the result of outliers elimination based on the Grubbs test. The primary interpretation of the results is below.

Table 1

Basic statistical description of the SMEs key performance indicators

Statistics		NACE C			NACE D			NACE H					
	ROE	FINLev	CFonSale	ROE _C	FINLev _C	CFtoSale _C	ROE _D	FINLev _D	CFtoSale _D	ROE _H	FINLev _H	CFtoSale _H	
N	Valid	136	136	136	112	112	112	4	4	4	20	20	20
	Missing	0	0	0	0	0	0	0	0	0	0	0	0
Mean	,129	2,574	-,120	,128	2,344	-,136	,221	6,172	,023	,115	3,143	-,060	
Median	,074	1,627	,000	,069	1,572	,000	,129	6,193	,021	,077	1,358	,000	
Std. Dev.	,300	4,337	3,508	,299	3,672	3,863	,258	4,489	,033	,320	6,950	,523	
Variance	,090	18,809	12,308	,090	13,486	14,920	,067	20,150	,001	,102	48,302	,274	
Minimum	-,541	-12,298	-37,214	-,541	-9,973	-37,214	,027	1,724	-,009	-,437	-12,298	-2,084	
Maximum	2,435	27,753	16,093	2,435	27,753	16,093	,600	10,580	,062	1,141	25,187	,955	

Source: Own calculations

We also calculated certain percentiles (deciles and quartiles), so we can understand the distribution of the indicator. The results of this are shown in Table 2. Again, key performance indicators are also calculated for CZ-NACE C, D and H sections.

Results shown here are already after the outliers elimination based upon the Grubbs test, percentiles are highlighted for easier orientation in Table 2. The main issue which is present in the tables is variability. We already have a similar experience with such kind of research of the logistic SMEs according to the article, and our results correspond with previous findings (Sikorová et al., 2015).

Table 2

Percentiles for return on equity, financial leverage and cash flow on sales

Statistics		NACE C			NACE D			NACE H					
		ROE	FINLev	CFonSale	ROE _C	FINLev _C	CFtoSale _C	ROE _D	FINLev _D	CFtoSale _D	ROE _H	FINLev _H	CFtoSale _H
N	Valid	136	136	136	112	112	112	4	4	4	20	20	20
	Missing	0	0	0	0	0	0	0	0	0	0	0	0
Percentiles	10	-,085	1,042	-,059	-,086	1,038	-,059	,027	1,724	-,009	-,368	1,004	-,089
	20	,000	1,127	-,030	,000	1,111	-,029	,027	1,724	-,009	-,044	1,103	-,034
	25	,006	1,183	-,016	,002	1,180	-,016	,046	2,027	-,006	-,014	1,164	-,032
	30	,018	1,253	-,009	,020	1,255	-,011	,065	2,329	-,004	,009	1,190	-,023
	40	,041	1,365	,000	,039	1,368	,000	,103	2,934	,000	,026	1,243	,000
	50	,074	1,627	,000	,069	1,572	,000	,129	6,193	,021	,077	1,358	,000
	60	,109	1,930	,002	,107	1,822	,004	,155	9,452	,041	,157	1,939	,000
	70	,161	2,343	,019	,157	2,218	,018	,378	10,016	,051	,203	2,437	,016
	75	,176	2,800	,034	,164	2,470	,038	,489	10,298	,056	,226	2,774	,024
	80	,205	3,107	,043	,191	3,001	,049	.	.	.	,236	3,498	,027
90	,387	5,232	,091	,382	4,616	,094	.	.	.	,411	13,314	,053	

Source: Own calculations

According to the results in Table 1 and Table 2, we can see that SMEs are very variable class. Just by comparing the statistics Mean and Median (for all 136 respondents) we can see, that for ROE (Table 1) the Mean is almost 12.9%, and Median is 7.4% (if we multiply ROE by 100%). If we compare these results with previous research (Klapper et al., 2002), these results are worse. The study from Klapper et al. (2002) observed for SMEs in Eastern Europe the median of ROE to be approximately 9%. That is the slightly negative message as (stated before), this confirms the hypothesis that Olomoucký region is a region when compared to the former Eastern countries. The Mean, which is not very resistant to extreme values, and the “really” extreme values have been already excluded by Grubbs test, is almost two times bigger than Median. This suggests that even after Grubbs test, there are companies with extremely high ROE, highly successful companies, which are still not taken as outliers, yet can be compared with the average. For further research, the companies can be structured on the above average successful share and below the average share and then compared, what are the key sources of success. This is also (for ROE) supported by the Std. Dev. (standard deviation), which is 30% (again, after multiplying by 100%). If we compare this value with the deciles shown in Table 2, we see, that even 8th decile is smaller (20,5 %) than the standard deviation (30%) and 9th decile is just slightly higher (38.7%). The difference between the minimum and maximum – range – for ROE is 2.976. Almost 300% difference between the minimum and maximum where Mean can be covered 23 times and Median 40 times. Even the spread of lower quartile (0.006) and upper quartile (0.176) – interquartile range – 0.17 is bigger than Mean as well as Median where Mean can be covered 1.32 and

median could be covered 2.3 times. Similar results are shown for the CZ-NACE C, D and H sections. This suggests that SMEs cannot be treated as one group of companies and further analysis is needed.

If we shift our focus to financial leverage (FINLev), Mean is 2.574 and Median 1.627. Again, quite a difference, even though not that big (relatively) as for ROE. Again, this is already after excluding outliers based on Grubbs test. The comparison with ROE suggests that the way SMEs are financed is not that variable as their performance. On the other hand, comparison to the rest of the Czech Republic (Klapper et al., 2002), the Median for Financial Leverage is 1.11. Companies are using more debts; they do not have their own capital. The Median for the Eastern Europe is 0.98. Again, this suggests that Czech SMEs and Olomouc SMEs, in particular, are less equipped with equity, they need “help from the outside” to run the business.

Standard deviation is 4.337, which again is higher than 8th decile, 80% of SMEs. If we calculate minimum vs. maximum spread, we see that it is 40.051 and this can cover the Mean 15.56 times and Median is covered 26.62 times. If we use the interquartile range for FINLev, we see that the value is 1.617, which covers Mean “only” for 0.63 and Median is covered for 0.99, so it is almost equal. These values are smaller than for ROE. This suggests that while still very variable, indicator FINLev for SMEs is more stable, and the main group (interquartile) of companies are quite consistent in the area of financial leverage.

Finally, what we see for CFtoSale is that Mean is -0.120 and Median value is 0.000 while Standard Deviation is 3.508. The minimum and maximum spread are 53.307 which (as Median is 0.000) can be compared only to Mean and Mean are covered 444.23 times (in absolute values). The interquartile range, in this case, is 0.05 and that covers Mean only by 0.42. That suggests that despite interquartile range being quite consistent and excluding outliers using Grubbs test, the first and last 25% of companies are very variable, where the absolute value of minimum is 2.31 times higher than maximum.

The conclusion based on the calculated statistics, there is more variability in the cash flow than in the profit the most “stable” indicator is financial leverage. Also, with the cash flow the negative performance is “deeper” than positive, for the ROE it is vice versa. Generally speaking, SMEs in Olomoucký region have lower performance and lower equity than the SMEs among the Eastern Europe according to the comparison with (Klapper et al., 2002). In this context, Olomoucký region is simply weaker and less successful.

DISCUSSION: DESCRIPTION OF SELECTED COMPANIES ACCORDING TO CZ-NACE AND THE GEOGRAPHIC LAYOUT OF INDUSTRIAL SMES FROM THE OLOMOUC REGION

From the economic perspective, it is interesting to have a look also at the geographic layout of engineering SMEs in the Olomouc region (CZ-NUTS 3 administrative unit). One can reveal basic spatial distribution by only displaying the SMEs on a map (Figure 1). It is visible that the highest concentration of SMEs is around major regional towns, especially around the biggest one – Olomouc – where most of the SME are located in industrial areas eastwards from the city centre. It is also possible to find out basic spatial dependencies by applying spatial proximity tools (buffers). Five and ten kilometers buffers around major towns’ centroids and roads (highways and 1st class roads) were used for this purpose. From this analysis, 116 out of 160 localized companies lay within 5 kilometers from towns’ centroid and 148 within 10 kilometers. It analytically proves the statement of spatial concentration of studied companies. One of the important factors from the economic geography perspective is also higher-class road network connectivity of businesses. From this point of view, 140 out of 160 localized companies are within 5 kilometers wide strip around higher-class roads, and 150 lay within 10 kilometers. When we compare the study of the Czech Statistical Office (2015) is confirmed expect the agricultural industry that most people are employed in the

industry which can be evaluated as very favorable from the perspective. Development of the Olomouc region is in good condition which has invested a lot of money into transport infrastructure in last years because quality and efficient transport infrastructure is one of the conditions for successful regional development and support of small and medium-sized enterprises (Olomoucký kraj, 2015). Therefore, it is possible to state that studied companies are very well connected in this sense.

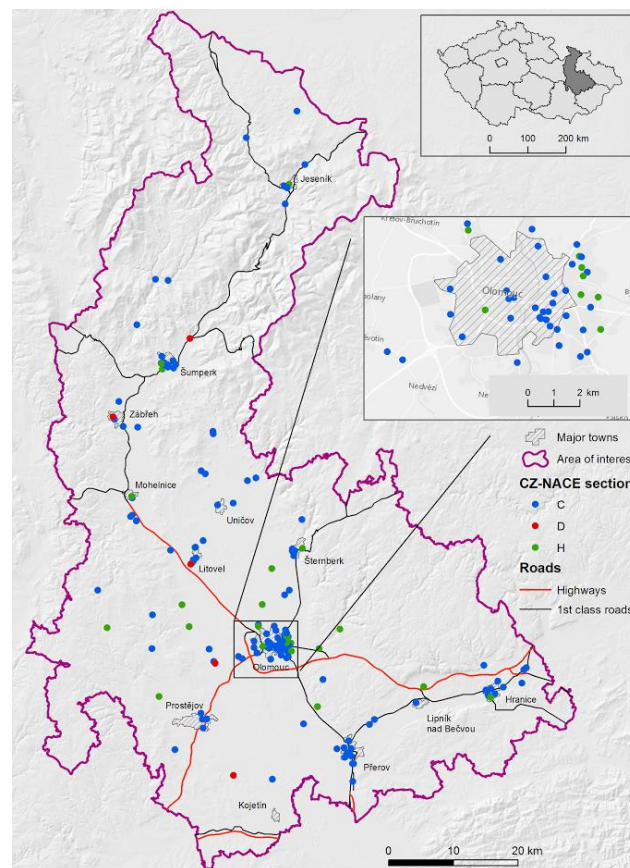


Figure 1. Spatial distribution of engineering SMEs according to CZ-NACE section

By looking at the CZ-NACE structure of the SMEs, it is clear that most of the companies fall into section C (manufacturing) and are more or less equally located in major towns and their close surroundings throughout the study area. On the other hand, companies in section H (transportation and storage) are placed either on outskirts of major towns (especially in case of Olomouc) or in relatively higher distances from them. It is probably due to the companies' demands for larger shed and parking sites, which are rather limited within larger towns. It is confirmed by a study of the Czech Statistical Office (2015) about the largest population, jobs and employers which they are in the five the largest region cities. More detailed structure of SMEs divided into CZ-NACE sections is in Figure 2. Within the manufacturing industry the sector 25 (manufacture of fabricated metal products, except machinery and equipment) is traditional range of the Czech economy and permanently it has owned a prominent place in sphere of whole manufacturing industry and it is characterized by growth dynamics especially in engineering and investment in the automotive industry.

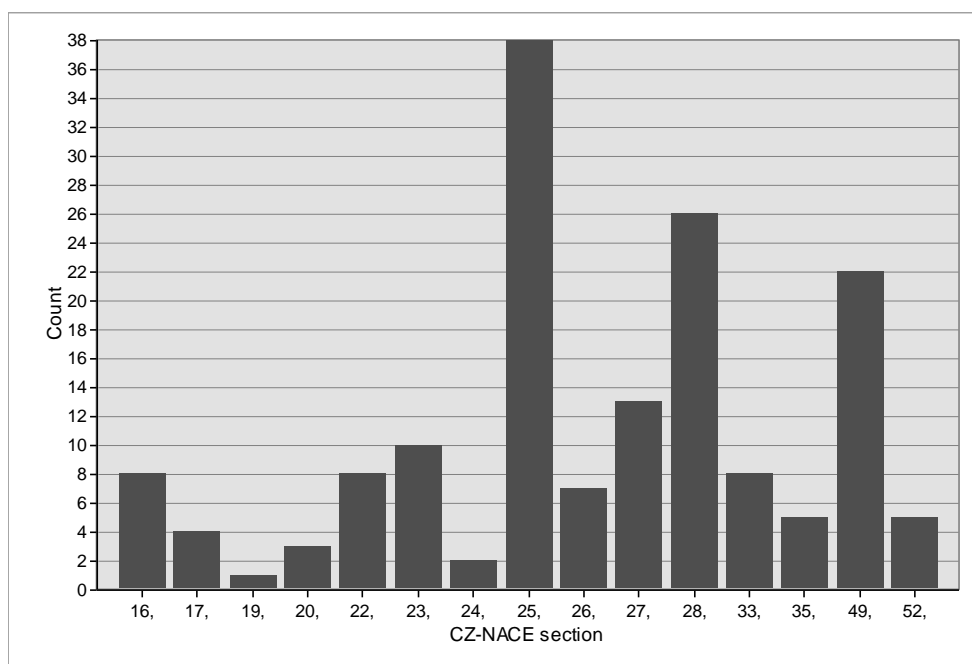


Figure 2. Summary statistics of localized companies according to CZ-NACE sections

When looking at the spatial distribution of SMEs according to ROE (Figure 3 left), it is clear that companies with higher ROE rates (more than 0.11) are concentrated in all the major towns and their close surroundings, except Litovel. Hranice, Uničov and Lipník nad Bečvou contain only one company with ROE greater than 0.11. On the other hand, companies with negative ROE rates are located mainly in Olomouc in the middle of the region and around Přerov on the southeast. Maximum and minimum values are observed as 2.4, -0.5 respectively. The indicator shows the fact, that companies do not increasing the share of foreign capital and they use mainly their own resources. Generated profit is used as a source of financing their activities. SMEs prefer to use their invested capital which adds value more than they would total interest paid. The spatial arrangement characterized by the financial leverage of engineering SMEs, Figure 3 (right), shows that the greatest degree of utilization of foreign capital is in the companies based in (or around) Olomouc, Hranice, Litovel, and Přerov. Most of the SMEs have FINLev in positive values (most frequently in the range from 1 to 3) and only five companies in negative. Maximum and minimum values are observed as 27.8, -12.3 respectively. Greater utilization of foreign resources contributes to an appreciation of equity. It is confirmed particularly in cities outside the capital city of the region (Olomouc). Concerning the last computed indicator, CFtoSale, map in Figure 4 exhibits low dispersion from 0 values. Almost all of studied SMEs are in the range from -2 to 2, and there is also no distinct visual spatial pattern of their distribution. Only in the north of a study area, six out of seven SMEs are in negative values of CFtoSale. Maximum and minimum values are observed as 16.1, -37.2 respectively. Indicator ROE and CFtoSale show positive cash flow in the company which later remains in the company as the net profit. Thus, the company believes more in the exploitation of the profits as a form of financing. Although it is possible to identify spatial distribution visually on a map, the analytical approach can describe a spatial pattern statistically. To do so, spatial autocorrelation, namely Moran's I (for description see e.g. Moran, 1950, Cliff and Ord, 1981, Goodchild, 1986), for each indicator was performed. Spatial correlation evaluates the correlation of selected variable (in this case one of the indicator) among nearby locations. According to Moran's I, there is no spatial

autocorrelation found among SMEs, and their spatial pattern does not appear to be significantly different than random.

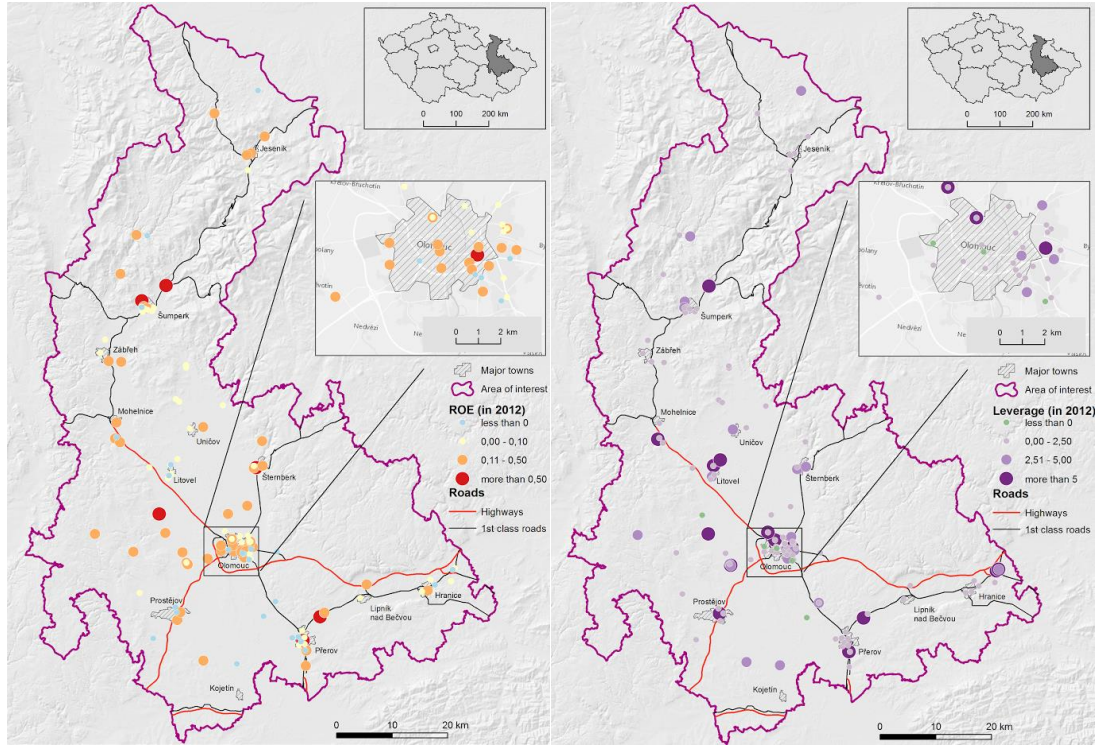


Figure 3. Map of the return on equity (left) and financial leverage (right) of the engineering enterprises

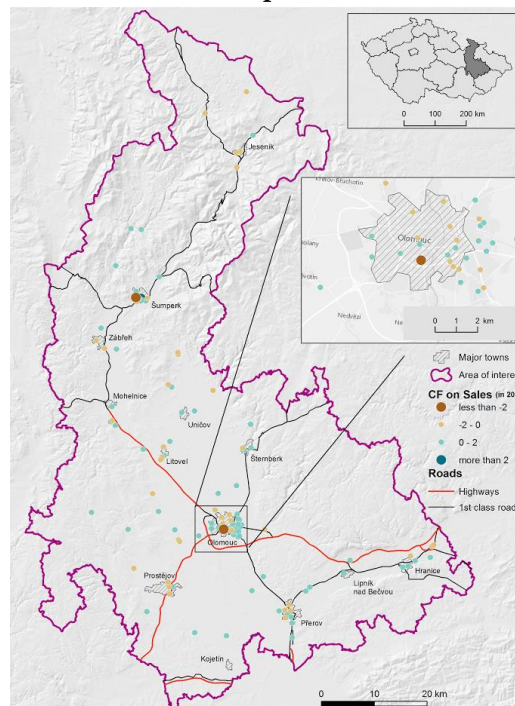


Figure 4. Map of the cash flows of the engineering enterprises

CONCLUSION

We conducted research focused on the engineering SMEs from the Olomoucký region. Based on our findings, we can conclude two observations. First, in the international context of the Eastern Europe, the SMEs in the Olomoucký region are weaker. They do have worse performance measured by ROE and less Equity measured by financial leverage. This implies that they generally contribute less to the GDP than they should according to the situation in Czech Republic, and for example in Germany, where SMEs play an important role. Also SMEs in Olomoucký region have problems to be financed by equity – entrepreneurs need the banks (or investors) to get involved. We are now also conducting following research for the period of 2013-2015 and preliminary results show that the impact of economic situation in Europe is finally affecting the Czech Republic. The economy of the country is strongly connected with the Germany and for the following period (2013-2015) we expect slightly worse results than presented in this paper.

The second conclusion based upon the descriptive analysis is related to the variability. Our findings suggest that despite the SMEs are often treated as one group of entities; they are not. The variability measured by ROE, financial leverage and cash flow on sales are simply too big. Even though all companies in our paper are from the same group of CZ-NACE, they do not form homogeneous mass. Interesting is that financial leverage has shown the lowest variability, which suggests that if we focus on profits or cash flow (generating money), companies perform with great variability. If we focus on the financial structure and capital structure – it seems that this is not the source of financial success or failure. Hence we should focus our future research more on ROE and CF.

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