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Professional paper

SUBNATIONAL REGIONAL COMPETITIVENESS: ANALYSIS OF HUNGARIAN MANUFACTURING FIRMS

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Abstract

It is one of the key targets of both national governments and the EU to reduce regional development differences. This paper reviews the proof of existence and potential explanations of subnational regional deviations in competitiveness. Then, the financial data of a sample of Hungarian manufacturing firms from the 2010-2014 period is analysed for regional effects. Based on this data, we cannot reject the existence of regional effects; however, they mainly show up in export intensity, labour efficiency and wage level, rather than in entities' profitability. Compared to the dispersion among firms within the same region, sub-sector, and size-category, the effect of regional factors seems to be modest. One of the main contributions of this article is to contrast the EU regional competitiveness index with financial statement data in order to show that firm-level competitiveness in Hungary is hard to track by regional indices, as some factors are over-weighted while other variables are missing from those measures. In particular, spatial characteristics like the proximity of more developed areas and central location within a given wider country area are missing.

Keywords*: ownership, export, index, efficiency, wage level, spatial differences*

JEL Classification*: G32, L25, M13, M38, P25, R58*

Introduction

The reduction of regional economic performance differences has recently been in the spotlight not only in most of the countries, but also as one of the key targets of the EU development policy. Still, the origin of these differences is far from being clear. The resource-based view of companies suggests that, besides the industry structure, corporate resources and capabilities are the primary determinants of business performance. At the same time, traditional international business research concentrates on country-specific factors as the key drivers of the same. This paper, together with various others, suggests that between the micro and macro levels, there

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is a mezzo-level of factors that affect corporate competitiveness and are linked to the characteristics of a given region. But what factors drive these differences? Are these drivers statistically significant, even if controlled for differences in firms' size, industry, and ownership? Can the currently measured regional factors give a good enough explanation of spatial differences? This paper investigates these issues based on a sample of Hungarian manufacturing companies.

It is important to note that literature uses the term region both for a group of countries (sometimes even for a continent) and specific areas of a given country (subnational regions). This paper will only apply the latter meaning (part of a country). Research techniques employed in literature differ widely starting from a questionnaire-based qualitative management research, through covering regional level statistical analyses, to the comparison of company-level data on performance measures. This diversity is explained by the different definitions of (subnational) regional competitiveness. On one hand, we may consider and compare the performance metrics of the regions themselves, and on the other, we could work with those of an average company operating in each of the areas. To understand how these two interpretations may differ, we have to consider the different approaches to performance. Competitiveness of firms is usually traced by well-defined performance measures (efficiency, profitability, growth, export intensity), while that of a region seems to be more complicated to judge. Among others, population (migration) trends, unemployment levels, average standard of living, local economy sustainability, the number of companies operating in the area, sum of local (regional) tax revenues or total GDP generated in the region and the change of all those measures are just some of the possibilities. (See also Schrieder, Munz, and Jehle, 2000)

Thus, it is vital to tell apart competitiveness of companies operating in a given region from the competitiveness of the region itself. This paper focuses on the competitiveness of firms, and contrasts the two approaches only briefly. The rest of the article is structured as follows. Based on relevant literature revision, core drivers of regional differences are identified. After the dataset description, the paper highlights the first results of an ongoing statistical analysis. The conclusion part summarises the main findings and further research directions.

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Causes of differences in regional economic performance

Literature contains a general view that huge regional disparities are typical for less developed countries, while these differences gradually disappear as the economy strengthens. (E.g. see Chan, Makino, and Isobe, 2010) Explanations as to why weak development may go hand in hand with regional differences vary from unevenly developed infrastructure through a diversity of local regulations to the heterogeneity

in entrepreneurial skills, training level and work culture of the population. Still, recent papers prove that regional disparities appear even in developed countries, and the effect of these should not be neglected.

It is clear that not all developing countries suffer from regional differences. Demchuk and Zelenyuk (2009) analysed the regional performance of Ukraine to find that there were no significant differences either among agricultural and industrial areas or between eastern (mostly Russian speaking) and western (mostly Ukrainian speaking) regions. However, they found that efficiency is strongly related not only to the amount of FDI investment, but also to alcohol and tobacco consumption, and criminality. The paper explains the latter unexpected results by more efficient areas having wealthier populations.

At the same time, the neighbouring Romania showed serious regional dispersion. After investigating regional differences there, Schrieder, Munz, and Jehle (2000) underline the limitations of using GDP per capita as a measure of regional competitiveness. They also highlight the importance of shadow economies and farming for households' own use when analysing regional performance. Raluca, Goschin, and Gruiescu (2010) ten years later, showed that there were still vast differences among the eight development regions of Romania regarding the distribution of FDIs. They found that predominance of agriculture, a high proportion of rural population, weak transport and telecommunication infrastructure hinder regional development. Beside the quality of infrastructure, availability of cheap and qualified workforce and path dependency appear in the economic development: earlier privatisation processes also significantly explain the differences across regions. At the same time, Neagu (2011) concluded that the quality of human workforce (measured by the proportion of employees with higher education degrees) strongly correlated with the per capita GDP of Romanian regions. Focusing on Serbia, Jovanović, Bošković, and Manić (2012) showed that the development of trade is strongly connected not only to population trends and income level, but also to the industrial development and quality transportation infrastructure.

Understanding the limitations of the competitiveness measure chosen is vital even in more developed countries. Banerjee and Jesenko (2015) found that regions in Slovenia have diverged since 1999, based on per capita GDP, but (due to social transfers) converged regarding their per capita disposable income. However, this process might be slowed down in the future by factors like bottlenecks in transportation and commuting infrastructure (similarly to Serbia), and they stress the importance of labour and residential mobility in this process. Analysing the Bratislava (Slovakia) automotive cluster, Bardy (2010) concluded that biggest threats to fully exploiting the opportunities of cross-border supply chains are lack of trust and ability or willingness to cooperate, as well as insufficient decision-making power. Lack of application skills was second in rank. These results call attention to the importance of cultural differences that may retard or even block the spill-over effects from nearby, more developed areas or even those from culturally (technologically) isolated high-tech companies in a given region.

Based on firm-level data from Italy, Basile, de Nardis and Pappalardo (2014) emphasise

that it is not only the economic performance that may differ across regions, but also the business cycles. According to their results, various firm-specific variables (firm size, demand conditions and liquidity conditions) capture half of the differences in regional business cycles, and this phenomenon is not explained by structural differences in the local industry. Using long-term Italian data, Cellini and Torrisi (2014) showed that even reactions to economic shocks are different from region to region. These results are relevant when considering limitations of regional competitiveness research, since when comparing performance measures, it is rare to control for possible differences in regional reaction to business cycles or shocks. Also based on Italian data, Di Liberto and Sideri, M. (2015) showed that past historical institutions seriously determine the current public administration quality (another example of path dependency), and the latter affects the economic performance of the regions.

Severe regional differences are present even in developed countries like Germany. Investigating 92 municipalities in East Germany from 1995 to 2000, Blume (2006) concluded that differences in local economic policies explain a significant part of the variation in the local business climate. Instead of focusing on competition only, successful economic policies included a balanced mix of traditional instruments (consulting, real estate management, investment in infrastructure) and modern, competition-oriented activities (city marketing, new public management, regional cooperation and public-private partnerships). He highlights that municipalities which concentrate on business-orientated investments in infrastructure (industrial land, science parks) and reduce investments in household-orientated infrastructure (social welfare, arts and culture), are more successful in regional competition. Given that the required amount of social welfare spending depends heavily on the general income level of the population, the latter could also have a strong influence on regional competitiveness.

Fertala (2008) underlined that even the survival rate of new firms depends on regional characteristics. In Upper Bavaria, she found an inverted U-shape connection between population density and survival chances, and identified a negative relationship between unemployment and survival. Staying in Germany, Wagner (2008) underlines that there is a remarkable gap regarding the proportion of exporting firms between West and East Germany. While in the West, two in three manufacturing companies were exporters in 2004 (fourteen years after the reunification), the same ratio was below fifty percent for the East part of the country. The average export to sales ratio was 18.83 percent for West and 10.89 percent for East Germany. His results show that this difference can only be partly (10 to 17 percent) explained by classic firm-specific issues like differences in size, productivity, and technology intensity, leaving enormous room for further less often considered effects.

Kourtit, Arribas-Bel, and Nijkamp (2012) underline that small and large firms tend to have their own performance profile even in the Netherlands. Thus, a kind of separate development duality exists even in developed countries, and thus, regional investigations should control for structural differences in companies' size. At the same time, the level of urbanisation and geographical location seem to have similar effects on companies regardless of their size. Interestingly, top performing large firms tend

to locate next to each other, while this is not true for top-performing SMEs. Gellynck and Vermeire (2009) interviewed food companies in a Belgian sub-region to learn that local networking boosts R&D and quality assurance, items usually assumed to be strongly linked to competitiveness. They also emphasise that public support to these networking activities could be crucial to the success of the latter.

As for Spain, González-Pernía, Peña-Legazkue, and Vendrell-Herrero (2012) showed that higher capacity of a region to simultaneously generate new knowledge and start-up firms is positively linked to its level of competitiveness. They conclude that for an increase in competitiveness (economic growth) of a region, innovation and entrepreneurship are needed at the same time, and these two factors usually appear together in small and new companies. Webber, Boddy, and Plumridge (2007) showed that even in Great Britain spatial effects play a significant role in explaining the differences in business performance (labour productivity). According to their results, peripherality implies a significant penalty in productivity and competitiveness. They underline the importance of both the transport infrastructure and e-mobility (internet access, computer literacy), and showed that the reduction of poorly trained workforce proportion and the boost in the availability of highly-qualified workforce both promote economic performance. Interestingly, their results suggest that concentration of low-skilled labour is more harmful in peripheral areas than otherwise, a result that may support the idea that these regional effects are more likely multiplicative rather than additive.

As for EU-wide comparison, Bosma and Schutjens (2011) concluded that there is a significant regional difference regarding entrepreneurial activity and attitude across Europe. Urban regions and areas with high start-up activity nearby, showed a relatively high rate of entrepreneurship across the whole sample of 17 countries. They found that the number of people with entrepreneurial attitudes and the number of those realising these ambitions differ widely in some regions (mainly in Sweden and Ireland) while other areas (North-East Germany, Northern France) show nearly no gap. When explaining this difference, national forces dominate in some countries (Sweden, Ireland, and The Netherlands), while regional effects play the most significant role in some others (Italy, Hungary, Norway).

Doloreux, Amara, and Landry (2008) focused on knowledge-intensive business services of Quebec, Canada. They found that location does not make a difference in characteristic features and innovation performance of these entities, but sub-sectors do. Authors explain their findings by focusing only on technology innovation, while performance in omitted “soft” innovation that is dependent on co-production with clients may show regional differences or concentration.

Examining Mexican manufacturing industry, Braun and Cullmann (2011) concluded that some powerful municipalities in low-performing regions could “uncouple” themselves from regional trends. Their results show that companies in the northern states of Mexico operate on average more efficiently than those in the southern regions that suffer from a lack of technical efficiency in comparison to the north. They explain this difference by the geographical proximity to the U.S. (knowledge spill-over,

the proximity of markets, competitive pressure). The paper underlines that southern regions are dominated by micro firms that are unable to exploit economies of scale and employ low-skilled workforce. Insufficient infrastructure (especially regarding water) could also contribute to this difference in performance. The importance of local-level policymaking is highlighted by the existence of single „islands of excellence" even in the southern states.

Kolympiris, Kalaitzandonakes and Miller (2015) analysed location choice of academic entrepreneurs in the US. They showed that besides personal characteristics like age, proximity to knowledge assets (e.g. biotech firms, universities) and funding venture capital firms both play a significant role. Chan, Makino, and Isobe (2010) examined the subnational regional effect on foreign affiliate performance in the USA and China, finding that these effects are far stronger in the Far East. Their results are important not only because they show the existence of regional factors, but also because they highlight that (1) regional effects also appear in developed countries like the USA, (2) these factors have an impact not only on local companies, but also on foreign affiliates. They underline the importance of cultural and ethnic differences across regions. Interestingly, the paper found that the importance of regional and industry effects varies across regions and industries. This finding might be explained by regional comparative advantages like local policies favouring some specific industries only.

Remington (2016) calls attention to the fact that the business-government connection may have a major effect on the economic performance. Comparing the development of Russia and China, he lists fairness of courts, the intrusiveness of bureaucracy, and enforcement of competition rules as essential elements of that relation. Low level of education, access to finance (China), onerous tax regimes, and the time needed to deal with regulations (Russia) are also important factors. Besides that, Chinese local governments reward firms for being successful in international markets, but authorities do not save low performers from bankruptcy. At the same time, Russian business-government connection is often built on personal contacts and favoured firms in return for support of particular political interests. While Russian companies are more likely to complain of government interference than Chinese ones, they depend more on the state to protect them against competitors or to provide them with trained workforce. Interestingly, it is the local tax regulation differing widely across the country that hurts firms in China, meanwhile, in Russia, it is the single central tax regime that creates problems.

Table 1. Factors behind regional differences in competitiveness

Factors	Major elements
Infrastructure	Transportation, telecommunication, utilities, e-mobility, urbanisation level
Proximity to more developed areas	Competitive pressure, distance to markets, spill-over effects, cultural similarities/differences
Regional public administration	Institutions, regulations, development policy, taxation, incentives, criminality, support to local networks
Workforce	Level of training, availability, wage level, culture, ethnic characteristics, entrepreneurial attitude, labour mobility
Local demand	Population trends, income level, size of shadow economy, residential mobility
Stimulating business environment	Concentration of large firms, existence of large enterprises with developed technology relying on local suppliers, vivid start-up activity, nearby venture capital companies and knowledge sources (universities, R&D centres), well-operating business networks

Source: author, based on the literature review

Based on the literature review, we may identify several general factors, which possibly explain the differences in the competitiveness of regions within the same country. Each of them contains several different items, giving a good impression of the complexity of enhancing or just even measuring competitiveness. (Table 1.)

Regional differences in Hungary

Focusing on the EU regions of Hungary (Figure 1.), Katona (2014) calls attention to vast differences in development. The Central Hungary region that also includes the capital (Budapest) was above 160 percent of the national average GDP per capita in 2012 (Budapest alone showed a remarkable 217 percent value), while three of the other six regions were below 70 percent of the national average. As for migration, Central Hungary showed a positive balance, while two areas (Northern Great Plain, Northern Hungary) showed a significant fallback, and two others (Southern Great Plain, Southern Transdanubia) a slight loss due to migration effects.

Figure 1. Regions of Hungary

Szerb et al. (2014) investigated the entrepreneurial activity in Hungarian regions. They found that Central Hungary is the only region above the national average, while the remaining six regions showed no significant differences. At the same time, innovation capability everywhere lags behind the EU average, and only three of the seven regions have far more than 10 percent improvement, which proves the existence of some regional differences contrary to the case of the general entrepreneurial activity level.

Table 2. Competitiveness of Hungarian regions

Region	Basic sub-index		Efficiency sub-index		Innovation sub-index		RCI 2016	
Central Hungary (Közép-Magyarország)	34.44	125%	60.85	129%	56.63	197%	49.09	174%
Central Transdanubia (Közép-Dunántúl)	29.81	108%	51.05	108%	27.62	96%	30.90	109%
Western Transdanubia (Nyugat-Dunántúl)	31.88	115%	49.56	105%	28.12	98%	30.58	108%
Southern Transdanubia (Dél-Dunántúl)	24.31	88%	43.31	91%	24.93	87%	22.89	81%
Northern Hungary (Észak-Magyarország)	23.06	83%	40.78	86%	21.91	76%	20.07	71%
Northern Great Plain (Észak-Alföld)	25.75	93%	39.71	84%	19.68	69%	19.77	70%
Southern Great Plain (Dél-Alföld)	24.19	88%	46.08	97%	22.18	77%	24.30	86%
National average	**27.63**	**100%**	**47.33**	**100%**	**28.72**	**100%**	**28.23**	**100%**
EU average	**61.75**	**223%**	**61.27**	**129%**	**49.30**	**172%**	**53.38**	**189%**

Source: European Commission, 2017

When examining the European Regional Competitiveness Index 2016 (European Commission, 2017) for the seven regions of Hungary (Table 2.), we have to keep in mind that Central Hungary (Közép-Magyarország) suffers from a severe distortion because it includes the capital Budapest, that is far more developed than the areas of the same region around it, even knowing that we may see vast differences emerging among regions in the case of all sub-indices. Central Hungary ranks first in all aspects, Central Transdanubia and Western Transdanubia always rank second or third. The remaining four regions show a far weaker performance and are well below the national average.

Based on this, one may assume to find serious differences in the average performance of firms in these three groups of regions. At the same time, performance within these three groups of regions should be quite similar. The remaining part of the paper will focus on these corporate performance differences to check whether the competitiveness of regions measured by the EU has a close link with the competitiveness of companies in those areas. As it is shown later, this is not the case.

To calculate these indices, the European Commission uses 11 pillars (factors), of which two (macroeconomic stability and basic education, both included in the basic sub-index) have the same score values for all of the Hungarian regions and thus can only be used to measure national impacts and not the regional ones. The remaining factors are listed in Table 3. If considering all factors as equally important, we may identify three groups of regions of similar competitiveness level. (Table 4.) The first one only includes Central Hungary that is clearly in a leading position. The second group contains Central and Western Transdanubia, being slightly above the national average, while the remaining four regions form a distinct cluster of weak performance. A deeper analysis shows that Southern Transdanubia has slightly different problems than the rest of this underperforming group, as infrastructure and market size are the two problems typical only for this region in the whole country.

Based on the serious differences in regional competitiveness measured by the European Commission (2017), we may expect that the financial statements of firms operating in less favourable areas would reflect a weaker performance than those of companies from more developed regions. To check for a connection between the competitiveness of regions measured and the competitiveness of the companies in the given region, a detailed statistical analysis started.

Table 3. Competitiveness pillars of Hungarian regions
Basic sub-index

Region	**Institutions**		**Infrastructure**		**Health**	
Central Hungary	28.16	92%	31.10	132%	51.46	146%
Central Transdanubia	32.22	105%	30.35	128%	34.92	99%
Western Transdanubia	32.22	105%	31.44	133%	40.02	114%
Southern Transdanubia	32.22	105%	11.59	49%	33.24	94%
Northern Hungary	30.05	98%	19.87	84%	25.60	73%
Northern Great Plain	30.05	98%	22.90	97%	30.99	88%
Southern Great Plain	30.05	98%	18.19	77%	30.08	85%
National average	**30.71**	**100%**	**23.64**	**100%**	**35.19**	**100%**
EU average	**52.59**	**171%**	**38.30**	**162%**	**74.70**	**212%**

Efficiency sub-index

Region	Higher Education and Lifelong Learning		Labour Market Efficiency		Market Size	
Central Hungary	65.09	126%	62.71	112%	28.40	186%
Central Transdanubia	51.38	99%	62.96	112%	20.29	133%
Western Transdanubia	51.73	100%	62.28	111%	16.07	105%
Southern Transdanubia	49.28	95%	54.59	97%	8.82	58%
Northern Hungary	43.96	85%	50.83	91%	12.95	85%
Northern Great Plain	47.72	92%	44.87	80%	9.78	64%
Southern Great Plain	53.29	103%	54.93	98%	10.54	69%
National average	**51.78**	**100%**	**56.17**	**100%**	**15.27**	**100%**
EU average	**63.48**	**123%**	**60.12**	**107%**	**34.52**	**226%**

Innovation sub-index

Region	Technological Readiness		Business Sophistication		Innovation	
Central Hungary	56.84	120%	44.38	248%	60.10	221%
Central Transdanubia	52.61	111%	12.69	71%	25.85	95%
Western Transdanubia	52.46	111%	15.88	89%	23.48	86%
Southern Transdanubia	47.05	99%	16.84	94%	18.79	69%
Northern Hungary	40.90	86%	12.34	69%	21.79	80%
Northern Great Plain	40.48	85%	10.40	58%	18.64	69%
Southern Great Plain	41.59	88%	12.63	71%	21.54	79%
National average	**47.42**	**100%**	**17.88**	**100%**	**27.17**	**100%**
EU average	**67.05**	**141%**	**36.94**	**207%**	**40.65**	**150%**

Source: European Commission, 2017

Table 4. Summarised standardised competitiveness scores of Hungarian regions

Region	Total of Z-scores
Central Hungary	-3.41
Central Transdanubia	-8.23
Western Transdanubia	-8.08
Southern Transdanubia	-10.14
Northern Hungary	-10.91
Northern Great Plain	-10.93
Southern Great Plain	-10.12
National average	**-8.83**
EU average	**-0.56**

Source: European Commission, 2017

Methodology and sample

To examine the links between the home region and companies' financial performance, a database of publicly available Hungarian entities' annual reports was set up for the period 2010-2014. Information on ownership and employment was also added. The sample includes nonfinancial businesses that employed at least twenty people in 2010, declared clear ownership information (no offshore firms) and published full annual reports according to Hungarian Accounting Standards. (Under the Hungarian law, smaller companies may publish less detailed, simplified reports).

Only companies with continuous operations and positive equity throughout the whole analysis period were included in the sample. The state-owned enterprises and those that went through legal transformation (e.g. due to mergers and acquisitions) were excluded. Due to these restrictions, our sample is very likely to significantly over-perform the average of the corporate sector. After the above exclusions, 4166 companies remained in the sample, of which 1569 were foreign-owned. Firms in the sample covered 39.3% of the GDP, 38.7% of employment in the competitive sector in 2013 in Hungary and provided 65.3% of the total exports. Table 5. presents the structure of the sample.

To evade distortions due to differences across industries, the original sample was limited to companies in the manufacturing sector. Thus, the sub-sample includes 1522 firms, of which 52.9 percent were locally owned in the majority. As for size in 2010, 17.6 (total Hungarian economy above 20 employees: 6.2) percent of those had more than 250 employees, while 57.4 (32.9) percent employed 50 to 249 people. Firms were linked to a region based on the location of their headquarters. The analysis used the EU regions as a categorisation variable. Competitiveness was measured using various ratios calculated on a yearly basis. These cover the commonly used factors of corporate competitiveness in six dimensions and are shown in Table 5.

Table 5. Corporate competitiveness measures used

Factor	Measure
Growth	Annual percentage change in employment, Sales, EBIT*, and profit after tax*
Export performance	Export/Sales, export income growth
Technology level	Wage per employee
Productivity	Sales per employee, EBIT per employee, added value per employee
Profitability	EBIT/Sales, Added value/Sales
Efficiency	EBITDA/Invested capital (ROIC)*, Profit after tax/Equity (ROE)*

*To remove extraordinary effects values outside the range, -100% – +100% were not considered.

To identify any significant regional differences, both ANOVA tables and paired comparisons were used. The Anova table assumes equal variance across groups (regions) and tests whether differences in average performance of groups are significantly higher than differences within the groups themselves. The advantage of

this technique is having a lower error when estimating standard deviation, so even smaller differences in averages may be considered significant. Paired comparisons always compare two groups (regions) at one time to check for significant differences. The method uses the standard deviation estimated from the groups to measure whether group averages differ enough to be significant. In this case, Tamhanes T2 test was used to identify significant differences. For both techniques, a level of significance of 5 percent was applied. The zero hypotheses in case of both methods are that group averages differ, so a regional effect exists.

Besides regional forces, based on literature, we may have differences among firms at least due to internal factors (e.g. culture, technology, size) and industry characteristics. The data make it possible to control not only for the type of shareholders (foreign/ Hungarian, a proxy for management culture) and size (based on employment), but also for sub-industries. A step-by-step analysis was used to remove these effects. Regional effects are assumed to last for several years even if changing in strength. Thus, only the results that appeared for at least three years of the five-year period examined were considered.

It is fundamental to see that regional effects might be defined in at least two ways. (1) We may categorise all effects caused by regions as regional (harder to separate statistically), or (2) we may focus only on differences across regions that are not explained by other than spatial variables (less exact). The latter definition would lose all regional factors that influence the control variables. Still, literature identifies some regional characteristics that may distort the distribution of size, ownership or sub-sectors of firms (preference of FDI, the concentration of large enterprises, sector-specific regulations). Thus, it is worth considering the differences across regions even without some of the control variables.

Primary results

As a first step, all firms considered showed regional differences. Anova tables identified significant differences for at least three years across the regions for four variables: Export/Sales (for the years 2010-2014), Wage/Employee (2010-2014), EBIT/Employee (2011-2013), and Added value/Employee (2010-2014), so differences emerged in three of the six dimensions. Paired comparisons confirmed not only these, but also found some significant differences between at least one pair of regions for Sales/Employee. (Variable values are shown in Table 6.) When checking the results, we see that serious regional effects appear and that Central Hungary has not always performed as best, while its regional competitiveness score is by far the highest. The drawbacks of the region regarding its export ratio and added value per employee are unusually high.

As a next step, manufacturing firms were separated based on the type of their majority ownership (foreign/local). For foreign-owned entities, differences in Export/Sales (2010-2014), Wage/Employee (2010-2015), Added value/Employee (2010-2014), and ROE (2010, 2012-2014) proved to be significant. For locally owned companies,

only Wage/Employee (2010-2014) and Added value/Employee (2010-2014) appeared to show significant regional differences. But even in case of overlaps, some of the regional effects do not match. While the region with the lowest wage level for foreign companies is Southern Transdanubia, in case of locally owned firms, Northern Great Plain performs the worst each year. (Table 7.)

Table 7. Wage/Employee (000 HUF) for all manufacturing companies

Region	N	2010	2011	2012	2013	2014
Foreign-owned firms						
Southern Great Plain	74	3649	3900	4074	4225	4184
Southern Transdanubia	48	2997	3224	3463	3604	4662
Northern Great Plain	69	3811	3997	4215	4322	4612
Northern Hungary	65	3730	4074	4210	4341	4513
Central Transdanubia	136	4198	4479	4702	4875	5082
Central Hungary	195	4858	5083	5366	5573	6353
Western Transdanubia	130	3729	4009	4307	4423	4546
Total	**717**	**4076**	**4331**	**4572**	**4729**	**5113**
Locally owned firms						
Southern Great Plain	74	2389	2565	2732	2860	2970
Southern Transdanubia	48	2417	2563	2737	2845	2966
Northern Great Plain	69	2343	2498	2650	2781	2838
Northern Hungary	65	2723	2980	3122	3249	3437
Central Transdanubia	136	2835	2993	3285	3428	3513
Central Hungary	195	2994	3207	3398	3562	3735
Western Transdanubia	130	2760	2948	3124	3306	3407
Total	**717**	**2699**	**2888**	**3074**	**3220**	**3346**

In case of Added value/Employee, we find similar discrepancies. The highest productivity for foreign companies was measured in Central Transdanubia in four of the five years, while for locally owned businesses, the top performer each year was Central Hungary, while Western Transdanubia scored second. Based on these results, it seems that regional effects are not independent of ownership (or management culture).

As a next step, firm size was added to the filter variables. When considering foreign firms with at least 250 employees, Export/Sales (2010-2014) (Table 8.), Wage/Employee (2010-2013), and Added value/Sales (2010-2012) appeared to reflect regional differences in the ANOVA tables. However, only Sales/Employee showed some significant paired differences each year. When focusing on mid-sized foreign-owned firms, export ratio difference disappeared, while Wage/Employee (2010-2014), Sales/Employee (2010-2013), and based-on-paired-tests Added value/Employee were identified as significant.

Table 6. Regional differences for all manufacturing companies*

Region	N	2010	2011	2012	2013	2014
Export/Sales						
Southern Great Plain	190	45.60%	45.31%	46.61%	47.24%	47.45%
Southern Transdanubia	103	52.17%	53.68%	53.48%	53.53%	62.53%
Northern Great Plain	197	43.40%	43.36%	43.94%	43.93%	42.47%
Northern Hungary	133	55.17%	55.91%	55.79%	55.06%	54.80%
Central Transdanubia	221	55.89%	56.87%	58.28%	58.41%	59.30%
Central Hungary	462	40.72%	41.39%	42.37%	42.41%	42.03%
Western Transdanubia	216	57.64%	58.39%	58.85%	58.79%	58.62%
Total	**1522**	**48.32%**	**48.90%**	**49.68%**	**49.72%**	**50.13%**
Wage/Employee (000 HUF)						
Southern Great Plain	190	2880	3085	3255	3392	3443
Southern Transdanubia	103	2688	2871	3075	3198	3756
Northern Great Plain	197	2857	3023	3198	3321	3459
Northern Hungary	133	3215	3514	3654	3783	3963
Central Transdanubia	221	3674	3907	4157	4319	4479
Central Hungary	462	3781	3999	4229	4411	4840
Western Transdanubia	216	3343	3587	3836	3978	4093
Total	**1522**	**3348**	**3568**	**3780**	**3931**	**4178**
Sales/Employee (000 HUF)						
Southern Great Plain	190	25318!	28926![1]	31658![1]	33109	34287
Southern Transdanubia	103	18196![1,2]	19462![1,2,3]	20585![1,2,3]	20838	22426
Northern Great Plain	197	27849!	29276!	30863!	30401	31719
Northern Hungary	133	27223!	31752!	31584!	32831	33700
Central Transdanubia	221	35707![2]	43293![2]	43708![2]	44289	44452
Central Hungary	462	40115!	45431!	46842!	44737	47037
Western Transdanubia	216	26082![1]	29224![3]	29213![3]	30132	30769
Total	**1522**	**31439**	**35716**	**36811**	**36634**	**37947**
EBIT/Employee (000 HUF)						
Southern Great Plain	190	1519!	1690	1460	1811	1981![1]
Southern Transdanubia	103	1067![1]	778	551	-288	948![1,2,3,4]
Northern Great Plain	197	2028!	2017	1832	1771	2023![2]
Northern Hungary	133	1148!	1318	1012	1642	1640!
Central Transdanubia	221	1906!	2600	2399	2529	3063![3]
Central Hungary	462	1951![1]	1921	1955	2063	1875!
Western Transdanubia	216	1751!	2295	1788	2104	2189![4]
Total	**1522**	**1742**	**1926**	**1740**	**1871**	**2041**
Added value/Employee (000 HUF)						

Southern Great Plain	190	5297	5702	5681	6220	6445
Southern Transdanubia	103	4424	4312	4560	3871	5685
Northern Great Plain	197	5792	5958	5959	6080	6454
Northern Hungary	133	5498	5958	5837	6641	6852
Central Transdanubia	221	7097	8066	8136	8434	9127
Central Hungary	462	6905	7084	7409	7677	8035
Western Transdanubia	216	6222	6976	6766	7296	7571
Total	**1522**	**6200**	**6607**	**6690**	**6996**	**7462**

*Values not showing significant differences in Anova table are followed by an exclamation mark (!). Pairs showing significant differences for these columns are indicated by numbers in upper indexes ([1]).

Interestingly, the Export/Sales ratio for the biggest foreign-owned companies was significantly lower in Central Hungary than in all other regions (Table 8.), which could be explained by the fact that this area is the transportation hub of the country and thus, preferred by companies targeting the national market only. These results support the hypothesis that some of the regional effects vary across firms of different size.

Table 8. Export/Sales ratio of foreign-owned firms with at least 250 employees

Region	**N**	**2010**	**2011**	**2012**	**2013**	**2014**
Southern Great Plain	19	89.89%	89.21%	88.77%	89.26%	88.43%
Southern Transdanubia	10	86.89%	86.88%	86.05%	86.79%	87.72%
Northern Great Plain	18	92.73%	92.14%	91.41%	86.19%	83.85%
Northern Hungary	20	85.41%	86.32%	84.96%	85.44%	82.38%
Central Transdanubia	46	78.11%	79.54%	79.84%	81.73%	84.44%
Central Hungary	49	62.27%	62.68%	63.55%	63.30%	60.51%
Western Transdanubia	41	79.10%	79.83%	79.72%	79.45%	79.19%
Total	**203**	**78.04%**	**78.58%**	**78.56%**	**78.54%**	**77.88%**

While these results may hint the existence of regional effects, manufacturing industry covers a broad range of activities, so the different industry structure of the regions may be responsible for some of the significant differences. A more exact specification of the sector was needed to check the possible existence of these distortions. To keep the sample size at a maximum, only the most populated sub-industries were investigated. Table 9. describes the most populated sub-industries in the sample, for both ownership types.

Table 9. Most numerous sub-industries in the sample

Industry	N	Proportion
Locally owned		
Total	**805**	**100%**
Food manufacturing	168	21%
Metal product manufacturing	153	19%
Foreign-owned		
Total	**717**	**100%**
Metal product manufacturing	114	16%
Plastic and rubber product manufacturing	79	11%

In the case of locally owned food manufacturing companies, 101 (60 percent) were medium-sized; so to evade distortions due to size, this subsample was further investigated. The only significant difference emerged in Export/Sales ratio, as companies in Central Transdanubia had significantly lower results than Northern Great Plain. (Table 10.) For locally owned mid-sized metal product manufacturers, no significant differences were found.

Table 10. Export/Sales of locally owned mid-sized food manufacturers

Region	N	2010	2011	2012	2013	2014
Southern Great Plain	17	15.02%	13.72%	13.47%	13.89%	14.82%
Southern Transdanubia	7	11.16%	13.80%	12.83%	15.15%	15.26%
Northern Great Plain	29	24.09%	24.09%	24.91%	21.23%	20.15%
Northern Hungary	8	29.98%	24.53%	26.40%	30.30%	27.43%
Central Transdanubia	3	3.73%	5.26%	2.95%	1.90%	0.60%
Central Hungary	28	9.34%	11.36%	12.46%	14.32%	15.02%
Western Transdanubia	9	13.97%	13.79%	11.54%	9.86%	12.61%
Total	**101**	**16.54%**	**16.66%**	**16.97%**	**16.79%**	**16.82%**

Altogether 78 (68 percent) of foreign-owned companies in the metal product manufacturing sub-industry were medium-sized entities. When assuming the same variance for all regions, significant differences were identified both regarding export activity and wages paid. (Table 11.) Surprisingly, the poorest export intensity was measured in Northern Great Plain, which is very hard to explain since the region does not only have below the national average market size (local market focused operation is difficult to imagine), but is also weak at infrastructure (the domestic market is difficult to serve). (Table 3.) So here, some negative regional factor could lie in the background. In case of plastic and rubber product manufacturers, no significant differences could be found.

Table 11. Export/Sales and Wage/Employee of foreign-owned mid-sized metal product manufacturers

Region	N	2010	2011	2012	2013	2014
Export/Sales						
Southern Great Plain	6	79.14%	78.75%	85.72%	89.20%	88.62%
Southern Transdanubia	11	82.80%	86.70%	88.78%	89.14%	89.88%
Northern Great Plain	6	51.21%	47.93%	55.00%	57.51%	51.51%
Northern Hungary	10	88.92%	88.30%	89.59%	91.41%	91.14%
Central Transdanubia	19	81.60%	81.15%	79.54%	77.89%	73.82%
Central Hungary	15	76.06%	75.31%	76.78%	75.78%	81.64%
Western Transdanubia	11	69.53%	70.99%	71.86%	73.21%	72.42%
Total	**78**	**77.41%**	**77.55%**	**79.10%**	**79.45%**	**79.04%**
Wage/Employee (000 HUF)						
Southern Great Plain	6	4056	4468	4601	4455	4466
Southern Transdanubia	11	3337	3504	3606	3637	3793
Northern Great Plain	6	4038	4498	4646	4568	4962
Northern Hungary	10	3264	3477	3790	3980	4041
Central Transdanubia	19	3715	4068	4217	4388	4420
Central Hungary	15	4941	5411	5520	5601	5625
Western Transdanubia	11	3477	3833	3998	4001	4160
Total	**78**	**3857**	**4202**	**4358**	**4427**	**4523**

Key results

1. Wage differences between Central Hungary and Northern Great Plain remained significant even when controlled for either ownership or size. The poor score achieved for the labour market efficiency pillar of the EU Commission competitiveness index of this region reflects this phenomenon correctly.

2. A lag in Export/Sales difference of Central Hungary for big foreign firms exists, which is not present in medium-sized entities. An explanation of this could be the fact that foreign companies willing to serve also the national market take profit from their central location and transport infrastructure of this region. This locational advantage within the country is not reflected in the EU competitiveness scores.

3. Southern Transdanubia had significantly lower Added value/Employee both for locally and foreign-owned companies independently of their size. This result is quite hard to explain by looking at the EU regional competitiveness scores, since only two other regions perform worse regarding efficiency.

4. When considering subsectors with the highest number of firms only, for locally

owned companies, Export/Sales ratios showed significant differences, but only in one of the sub-industries. This result might hint that the same regional forces influence competitiveness in each sector differently.

5. In the case of foreign-owned mid-sized companies, only one of the sub-sectors allowed for potential significant regional differences. In metal product manufacturing, both Export/Sales and Wage/Employee were found to differ significantly between at least two regions. Though, for the same variables, different areas showed significant differences in the case of locally owned mid-sized firms. An important conclusion of this is that regional effects exist even for foreign-owned companies that usually target international markets and are fewer, which could be explained by local differences in FDI policy.

6. No differences could be tracked for growth and profitability factors of competitiveness, and significant inequalities in profitability were also rare. It seems that firm-level competitiveness is very differently hit by regional factors, and that the EU regional competitiveness index showing huge discrepancies may be biased towards variables affecting mostly other pillars of firm-level competitiveness.

Summary and conclusions

Based on recent years' literature, there are many reasons why there could be regional differences in competitiveness within the same country. Key factors identified were (1) Infrastructure, (2) Proximity of more developed areas, (3) Regional public administration, (4) Workforce, (5) Local demand, and (6) Stimulating business environment.

One of the primary aims of the EU regional competitiveness index is to call the attention of decision-makers to factors that may cause gaps in the competitiveness of local companies. Based on this, the question arises of whether the regional differences across firms operating in Hungary are in line with the differences in the regional competitiveness index. In order to identify spatial effects, this paper analysed the average financial performance of Hungarian manufacturing companies. Statistics were controlled both for ownership (foreign/local as a proxy for management quality) and size (number of employees) to remove competitiveness effects of those factors. Besides focusing on the general manufacturing industry, for locally and foreign-owned entities, the two most numerous sub-industries were analysed separately.

Based on the tests performed, the existence of regional factors affecting the competitiveness of firms within Hungary cannot be rejected. Regional differences are particularly noticeable in the case of export ratio, wage level, and efficiency. Still, their effect varies across sub-industries (in line with the findings of Doloreux, Amara, and Landry 2008), size (as shown by Kourtit, Arribas-Bel, and Nijkamp, 2012), and ownership (similarly to Chan, Makino, and Isobe, 2010). Interestingly, no clear proof was found that these factors could influence profitability (ROI, ROE), meaning that lower wage level could compensate for moderate efficiency.

Another significant result is that the EU competitiveness index based on regional characteristics is far from being a perfect measure of tracing companies' competitiveness in Hungary. It seems that the dispersion among firms of the same size, with the same ownership background and even in the same sub-industry is far bigger than the effects of some factors included in the EU competitiveness index, while some factors affecting firms' competitiveness linked to regions are missing from the measurement. Examples of these could be the proximity of more developed regions or central location within the country.

A limitation of these results is that the methods applied allocate all significant differences to regional effects. Any effect of further hidden factors not tracked by the control variables would be included in our regional differences. Still, most of these omitted variables are firm-specific (age, management quality), and are usually not significant when explaining financial performance. Another possible limitation is that this paper accepted the EU statistical regions as a good base to investigate spatial effects. If based on their competitiveness, some of these regions belong rather together, while some existing regional differences could remain blurred.

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