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# A cross-country analysis of the effects of firm characteristics and regional factors on small firm competitiveness

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*This study explores the influence of firm characteristics and regional factors on firm competitiveness of Small and Medium-sized Enterprises (SMEs) using a cross-country analysis of Hungary and the Czech Republic, based on the Resource Based View (RBV) and insights from geographical economics and regional development frameworks. Cross-sectional regression models are used to analyze a dataset of 331 SMEs distinguished along urban and rural divide in the two countries. The findings of the study show that firm size has a positive and significant association with firm competitiveness suggesting the importance of a firm's scale in harnessing competitive advantage. Firm age relates negatively with firm competitiveness, indicative of the likely inertia challenges faced by older firms thus affecting their propensity to adapt to market dynamics as well as to innovate. While the study fails to validate significance of urban-rural location dichotomy as a predictor of competitiveness, firm agglomeration, measured by the number of firms in regional clusters positively relates to competitiveness, pointing to potential benefits of agglomeration economies. Based on the findings, targeted policy actions that consider the context of the environment in which firms operate are recommended in order to foster firm competitiveness. By adopting a comparative perspective, this study contributes to the understanding of contextual nature of SMEs. The study extends practical insights to firm owners, policy makers and development practitioners for fostering firm competitiveness.*

Keywords: *SME competitiveness, cross-country analysis, RBV, regional development, urban–rural location*

## 1. Introduction

The competitive dynamics of firms and their strategic positioning in various geographical locations have gained significant attention in strategy and regional economic development studies. According to the resource-based view (RBV), firms attain and maintain a competitive advantage by acquiring and managing resources that are valuable, rare, inimitable, and non-substitutable (Barney 1991).The theory of firm-specific attributes has been widely used to explain how heterogeneity in performance outcomes occurs (Barney et al. 2001, Peteraf 1993).

Studies have expanded the Resource-Based View (RBV) to investigate the spatial aspects of firm competitiveness. These studies emphasize the importance of urban versus rural settings in shaping firm strategies and resource configurations (Porter 1998a). The distinction between urban and rural areas is crucial because it affects access to resources, market opportunities, and competitive pressures (Krugman 1991, Scott–Storper 2015). Urban regions, which are characterized by higher population density and greater economic diversification, offer firms a variety of competitive advantages. These include access to larger markets and pools of skilled labor (Florida 2002). Conversely, firms in rural areas face distinct challenges and

opportunities. These include lower competition intensity but also limited access to critical resources and networks (Storper–Venables 2004). The location influence on firm competitiveness is similarly affected by country-specific factors, such as institutional frameworks, economic policies, and regional development initiatives (North 1990). Cross-country comparisons have shown significant differences in how firms use geographic and institutional contexts to create competitive advantages (Porter 2000, Saxenian et al. 1995).

Despite considerable theoretical and empirical evidence, the RBV, geographical economics, and regional development there still exist gaps in understanding the link between firm characteristics, competitive dynamics, and the urban–rural divide, particularly from a cross-country perspective. This study aims to investigate how firm size, age, and industry sector affect competitiveness in urban and rural regions of Hungary and the Czech Republic.

### *1.1. Study objectives*

The overriding purpose of the study is to explore the effect of firm attributes and geographical location influence on SMEs competitiveness within the framework of the RBV. Specifically, as follows:

- To examine the influence of firm characteristics, such as size, age, industry sector, and firm agglomeration (measured as the number of firms in established regional classifications, counties in the case of Hungary and regions in the case of the Czech Republic), on the level of competitiveness of SMEs;
- To explore the influence of firm location in urban and rural contexts across Hungary and the Czech Republic on firm competitiveness;
- To analyze the interaction effects between firm attributes, specifically size (measured by the number of employees) and geographical location (urban vs. rural), on firm competitiveness. The study establishes the firm-size effect moderated by firm location; and
- To compare the dynamics of firm characteristics and regional aspects on the competitive dynamics of SMEs in the two countries.

To classify locations as urban or rural in Hungary and the Czech Republic, the study uses zip codes associated with each firm in the dataset. Accordingly, administrative and economic centers of the NUTS 3 regions as identified by the zip codes are considered urban while local administrative units in the periphery of the NUTS 3 centers are considered rural. Similarly, the categorization of firms into regional clusters is determined by zip codes. This method allows for precise categorization of geographical areas and comprehensive analysis of firm concentration.

## 2. Literature review

### *2.1. Perspectives of competitiveness*

The notion of competition is a multidimensional and intricate phenomenon that may be examined at several levels of inquiry (Szerb–Terjesen 2010). The levels encompass macro, meso, and micro perspectives, each offering distinct perspectives on the essence of competitiveness. At the micro level, a company's internal resources and competencies, such as human capital, management style, innovation processes, and market positioning, contribute to its competitive advantage (Porter 1998b). Additionally, Shvindina (2022) proposes that benchmarking can also be used to measure micro competitiveness by comparing a firm either past or future performance indicators to its peers. The meso and macro levels consider competitiveness at Shining industry and national levels respectively.

Different factors have been cited as being affecting competitiveness. The theoretical framework suggested by (Chikán et al. 2022) emphasizes the significance of ordinary capabilities (OC) and dynamic capabilities (DC) in enhancing corporate competitiveness. In this case, operationality, which measures the result of ordinary capabilities, is required for a company to achieve its existing goals, whereas adaptivity indicates the company's capacity to adjust to shifts in resources and non-operational routines. In addition, Chikán et al. (2022) also discuss the concept of the Firm Competitiveness Index (FCI), which integrates financial and market competitive advantage based on the firm's technological and evolutionary fitness. This conceptual index is suggested as a way to measure how functional operations are regarded to contribute to overall firm-level competitiveness.

In similar assertions, employing a system dynamic approach to analyze the connection between resources and capabilities, Szerb et al. (2020) highlight that small firm's competitiveness is greatly influenced by the configuration of its resources and capabilities which when effectively coordinated catapults the firm to stand out from competition owing to better performance. These resources include human capital, product innovation, technology, and decision-making ability. Based on the Resource Based View of the firm (RBV) the authors emphasize on the combination and harmonization of configurations of competitive pillars as an effective way to remain competitive.

Drawing on a Polish perspective, Sipa et al. (2015) identify a range of factors as key influencers of small firms' competitivenessClick or tap here to enter text. The featured aspects include company image, product brand, lower product price, and focus on specific customer groups. Other factors include adaptability to market demand and innovation. To a great extent, this perspective aligns well with assertions by Szerb et al. (2020), who recognize the role of strategic management as one of the key pillars of competitiveness configuration.

Insights regarding the territorial characteristics influencing competitiveness are discussed in Metaxas et al. (2016). In this study, agglomeration factors and market access are observed to have insignificant positive influence on small and medium-sized firms' competitiveness, with improvement in this factor reducing the chance of small firm growing to medium-sized by 20%. Similarly, regional policies also

significantly impacted competitiveness with a negative influence against Southern European firms. Additionally, urban infrastructure such as transport networks, are found to be significant predictors of competitiveness. Labor availability and cost factors are also identified as significant competitive aspects from a regional perspective.

### *2.2. An overview of SME performance in Hungary and the Czech Republic*

SMEs play an important role in both Hungary and the Czech Republic, as is the case in many other countries globally. The European commission report on SME performance indicate that in 2022, SMEs accounted for the majority of business enterprises and employment. In Hungary's case, SMEs accounted for 99.9% of total business enterprises and employed 70.2" of the workforce, contributing 56.2% of the total value added. Similarly in the Czech Republic, SMEs accounted for 99.8% of total enterprises, employing 67.4% of the labor force and contributing 53.5% to value added (European Commission, 2023a, 2023b). while both countries recorded modest growth rates in the sector in nominal terms (3% in Hungary and 8% in Czech Republic), persistent high inflation rates dampened the real growth.

*Table 1.* A comparison of SMEs and large firms' performance in Hungary and A comparison the Czech Republic

| **Metric** | **Hungary SMEs** | **Hungary Large Enterprises** | **Czechia SMEs** | **Czechia Large Enterprises** |
|---|---|---|---|---|
| **Number of Enterprises** | 713,411 (99.9%) | 957 (0.1%) | 1,082,947 (99.8%) | 1,639 (0.2%) |
| **Persons Employed** | 2,051,172 (70.2%) | 872,712 (29.8%) | 2,551,953 (67.4%) | 1,236,587 (32.6%) |
| **Value Added (€ Billion)** | 46.5 (56.2%) | 36.3 (43.8%) | 74.4 (53.5%) | 64.7 (46.5%) |

*Source:* own construction based on European Commission SME performance report 2022

At the sector level, while SMEs across the various sectors in Hungary demonstrated resilience notwithstanding impacts of broader economic conditions, the performance in the Czech Republic was mixed with a notable dismal performance in the construction sub-sector.

Both countries face challenges that impact the sector with varied levels of influence. In the case of Hungary, critical challenges include shortage high-skilled sectors and an innovation performance below the EU average (European Commission 2023b). In contrast, SMEs in the Czech Republic face challenges with administrative and regulatory procedures as well as an entrepreneurial gap indicated by a limited number of start-ups (European Commission 2023a).

*Table 2.* Key challenges faced by SMEs in the Czech Republic

| Key Challenges | SME Impact |
|---|---|
| **Administrative and Regulatory Procedures** | Major obstacle to investment and business operations; considered a significant barrier to doing business due to fast-changing legislation. |
| **Limited Number of Start-Ups** | Reflects an entrepreneurial gap, placing Czech at 21st in the EU for start-up density; suggests potential underutilization of innovative business creation. |
| **Skills Shortages and Labour Market Needs** | 76% of businesses report difficulties finding ICT specialists, the highest in the EU; indicates a critical talent gap affecting digital transformation and competitiveness. |
| **Late Payments** | Affects SME resilience and growth, with 61% of companies experiencing late payments, significantly higher than the EU average of 43%. |

*Source:* own construction based on European Commission SME performance report 2022

### *2.3. Theoretical underpinning*

The measure of firm competitiveness in this study is drawn from the framework of the resource-based view of the firm (RBV) and the configurational theory. The key feature of the framework presented by the configurational approach to competitiveness analysis is its acknowledgement and emphasis of the comprehensive and interconnected nature of the factors affecting a firm's competitive position (Ketchen et al. 1993). This method acknowledges the intrinsic complexity of the business environment and goes beyond the conventional reductionist linear methods. This approach is constructed as a congruence following several theoretical propositions and frameworks.

The origin of the configurational approach lies on the configurational theory motivated by Miller and Friesen (1980), who assert that those configurations of aspects provide a more comprehensive understanding of organizational dynamics than the examination of individual factors separately. The theory therefore posits that a firm's competitive advantage usually results from the complex combination and alignment of different organizational aspects as opposed to from the total of the individual components. These components include, among the components, the diverse resources, procedures, structure, and strategy.

The RBV stems from the application of the configurational theory to explore the contribution to sustainable competitive advantage of specific configurations of resources and capabilities by Barney et al. (1991). As a key theory within the configurational approach, the RBV emphasizes that a firm’s competitive advantage stems from its unique and valuable resources, thus introducing the concept of valuable, rare, imitable and non-substitutable (VRIN) resources as key determinants of competitive advantage within the configurational philosophy. In this context configurations analysis involves identifying and aligning these resources in a way that creates a unique competitive position.

Based on the developments made by Barney on the application of the configurational in assessing a firm’s resources and capabilities, a number of studies

have followed in application of the RBV. In a novel study developing a system dynamic approach for assessing competitiveness (Szerb et al. 2020), the RBV is employed in the study to illustrate how resources and capabilities are interdependent and how their configuration affects performance and firms' competitiveness.

In essence, the approach emphasizes that the interactions of resources and capabilities result in the creation of competencies, which in turn contribute to improving a firm's competitive position and overall performance. This aligns well with RBVs proposition that competitiveness is a multidimensional contrast and relates positively with resources and capabilities.

## 3. Methodology

The present study uses a growing amount of data collected as part of the Global Competitiveness Project (GCP) survey (http://www.sme-gcp.org), which hitherto includes firm-level data from twelve countries across Europe, Asia, and South America. The data is classified into ten pillars, including domestic market, networking, internationalization, human capital, product, technology, marketing, online precedence, decision making, and strategy. Additionally, the dataset includes specific characteristics of firms.

The study covers a sample of 331 SMEs, with 199 firms in Hungary's sample – comprising 104 firms in the urban regions and 95 in the rural regions – and 132 in the Czech Republic's, comprising 38 in the rural setting and 94 in the urban setting. The sample was selected to include only firms classified as Micro, Small and Medium-Sized Enterprises (MSMEs) according to EU standards, and only those with complete data were included. Given that the dataset is expanding, data was collected at different times, with information pertaining to Hungary being collected in 2018 and that relating to the Czech Republic in 2019.

*Table 3.* Sample distribution

| SN | Country | Sample Size | Percentage of Total | Year of Survey |
|---|---|---|---|---|
| 1. | Hungary | 199 | 60 | 2018 |
| 2. | Czech Republic | 132 | 40 | 2019 |
| 3. | Hungary + Czech Republic | 331 | | |

*Source:* own construction based on survey data

The firms in the sample are classified into 21 categories based on NACE 1 classification which covers a broad range of industries, such as agriculture, manufacturing, construction, wholesale and retail trade, transportation, information and communication, financial and insurance activities, real estate, professional, scientific, and technical activities, administrative and support services, education, healthcare, arts, entertainment, and recreation, among others.

### *3.1. Description of variables*

#### 3.1.1. Dependent variable

The dependent variable in this study is the competitiveness score of firms, which is a unified index of their resources and capabilities inspired by the Resource-Based View (RBV). The dataset includes this metric for individual firms, which has been computed as the average score across ten pillars of competitiveness. Each pillar comprises various variables that contribute to the overall score. The methodology for deriving the competitive score for each firm is outlined as follows following (Szerb et al. 2020):

*Step 1. Normalization of variables*

Each variable within the dataset is normalized to a range of {0,1] using the following formulae:

$$x_{ij}^{*} = \frac{x_{ij}}{max(x_j)} \quad j = 1, \ \ldots . j; i = 1, \ \ldots . . N$$

Where *x** denotes the normalized value of variable *j* for firm *i*, *xij* is the original value of variable *j* for firm *i*, and max*(xj)* is the maximum of variable *j* across all firms. The normalization of the variables allows for consistency in measurement by scaling the values of each variable relative to the highest observed value.

*Step 2. Categorization of the variables into competitive pillars*

The normalized variables (J) are grouped into 10 vectors (v), each corresponding to the distinct competitive pillars defined based on the RBV. The pillar scores are the average value of the variables included in each pillar calculated as:

$$p_{iv} = \frac{\dot{a} \sum_{K=1}^{K} x_{i,v}^{*}}{K} \quad v = 1, \ \ldots \ldots . 10; k = 1, \ \ldots \ldots \ldots K$$

Where $p_{iv}$ is the pillar score for firm i in pillar v, $x_{i,v}^{*}$ stands for the normalized values within pillar v for firm *i*, and *K* the total number of variables within the pillar. These are then normalized as follows to allow for comparison across pillars:

$$p_{iv}^{*} = \frac{piv}{max(p_v)}$$

*Step 3. Computation of the Competitive Index*

Finally, the overall competitiveness index for each firm is as a summation of the normalized pillar scores:

$$CI_i = \sum_{1}^{10} p_{i,v}^{*}$$

Thus, the computed index indicates firm competitiveness score by combining various resources and capabilities into a single measure.

3.1.2. Independent variables

The independent variables of the study represent various aspects of firm attributes and geographical or locational settings. These variables are used to determine the effect of firm characteristics and regional aspects on firm competitiveness. Table 2 presents a description of each of the variables.

*Table 4.* Description of independent variables

| Variable | Description |
|---|---|
| Firm Size | Total number of employees within a firm. The range of possible number is {1, 248} based on the EU classification of MSMEs. This variable also captures the scale of firms. |
| Firm Age | Age of firm (in years) as at the time of the survey. It also captures the experience of the firms. |
| Industry share | Percentage share of industry in which firm belongs. It captures the share of the corresponding firm's industrial identity of the total industries in the sample. |
| Number of Firms in Industry | Industry size or concentration in which firms belong |
| Number of Firms in Region | Reflects regional density of firms, indicating a measure of clustering or firm agglomeration |
| Country Dummy: | Binary variable of firm's country of operation<br>1 = Hungary<br>0 = The Czech Republic |
| Location Dummy | Binary variable distinguishing between firms' location<br>1 = Urban<br>0 = Rural |
| Firm size and location interaction term | An interaction term to capture the impact of firm size within locational context. |

*Source:* own construction

## 4. Results and analysis

This study employs a quantitative methodology to explore the connections suggested by the stated objectives. A cross-sectional regression model is utilized to examine the impact of firm characteristics and regional factors on firm competitiveness.

### *4.1. Descriptive statistics*

Table 5 shows the summary statistics of the variable, suggesting a dataset with significant heterogeneity. The mean competitiveness score is moderate at 4.98, with scores ranging from 1.68 to 8.27 and standard deviation of 1.36, indicating significant heterogeneity in competitiveness scores among the firms in the sample. The mean of Firm Size and the median show significant differences, suggesting a right-skewed distribution of this variable with longer tail of firms having high number of employees. This suggests that within the sample, majority of firms are relatively small. With a standard deviation of 28.2, there is indication of high variability in firm sizes. Firm age appears symmetric with the equivalence in the mean and median (16).

Additionally, the mean age of 16 is suggestive of relatively well established and experienced firms in the sample. The standard deviation of Number of Firms in industry of 8.94 with a maximum of 38 and minimum of 6 and a mean of 16.5, reflects considerable variability in the number of firms across the industries. The regions exhibit a moderate firm density, with a high standard deviation indicating substantial heterogeneity in regional distribution of firms. The binary distributions of country and location dummies show a mean of 0.601, indicating a sample bias towards the referenced group.

*Table 5.* Summary statistics, using the observations 1 – 331

| Variable | Mean | Median | S.D. | Min | Max |
|---|---|---|---|---|---|
| Competitiveness_Score | 4.98 | 5.01 | 1.36 | 1.68 | 8.27 |
| Firm_Size | 18.6 | 9.00 | 28.2 | 1.00 | 220. |
| Firm_Age | 16.0 | 16.0 | 7.70 | 2.00 | 35.0 |
| Number_of_Firms_in_Industry | 16.5 | 13.0 | 8.94 | 6.00 | 38.0 |
| Industry_Share | 4.98 | 3.93 | 2.70 | 1.81 | 11.5 |
| Number_of_Firms_in_Region | 21.5 | 15.0 | 20.5 | 1.00 | 60.0 |
| CD | 0.601 | 1.00 | 0.490 | 0.000 | 1.00 |
| LD | 0.417 | 0.000 | 0.494 | 0.000 | 1.00 |

*Source:* own construction in Gretl software reformatted for readability

The correlation analysis presented in Table 6 shows the non-causal relationship between Firms Competitiveness Score and the various independent variables, as well as the relationships among the variables themselves. The correlation coefficient of 0.322 between Competitiveness Score and Firm Size is positive and moderate, suggesting that larger firms in terms of number of employees tend to have higher competitive scores, pointing to a possible importance of size in fostering competitiveness likely due to a range of factors such as a higher pool of talent, economies of scale, among others. A similar result is seen with respect to the correlation between competitiveness core and number of firms in regions. With a weaker coefficient of 0.153, enterprises in regions with a higher density of firms have a higher competitiveness score, pointing to possible benefits of agglomeration economies.

*Table 6.* Correlation analysis

| | **Competitiveness Score** | **Firm_Size** | **Firm_Age** | **Number_of_Firms_in_Industry** | **No_of_Firms_in_Region** |
|---|---|---|---|---|---|
| **Competitiveness Score** | 1.000 | 0.322 | 0.003 | -0.004 | 0.153 |
| **Firm Size** | 0.322 | 1.000 | 0.179 | -0.004 | -0.012 |
| **Firm Age** | 0.003 | 0.179 | 1.000 | -0.022 | -0.119 |
| **NO. of Firms in Industry** | -0.004 | -0.004 | -0.022 | 1.000 | 0.221 |
| **No of Firms in Region** | 0.153 | -0.012 | -0.119 | 0.221 | 1.000 |

*Source:* own construction in Gretl software reformatted for readability

*4.2. Inferential analysis*

A cross-sectional model is used to examine the relationships inferred in the objectives of the study. First, an aggregate model combining the samples in the two countries is estimated to establish aggregate effects. the model is generally presented as follows:

$$log\ (Competitiveness\_Score) = \beta 0 + \beta 1\ log\ (Firm\_Size) + \beta 2\ log\ (Firm\_Age) + \beta 3\ Country\_Dummy + \beta 4\ Location\_Dummy + \beta 5\ log\ (Number\_of\_Firms\_in\_Industry) + \beta 6\ log\ (Number\_of\_Firms\_in\_Region) + \beta 7\ L\_SxLD + e$$

Where Bo represents the intercept, B1. B7 are coefficients of the independent variables and e is the error term.

For estimation, the model is log transformed to linearize the equation and to allow for elasticity interpretation. In this case therefore a percentage change in an independent variable will lead to a percentage change in the dependent variable inferred by the coefficient of the concerned independent variable. The log transformed model is represented as follows:

$$log\ (Competitiveness\_Score) = \beta 0 + \beta 1\ log\ (Firm\_Size) + \beta 2\ log\ (Firm\_Age) + \beta 3\ Country\_Dummy + \beta 4\ Location\_Dummy + \beta 5\ log\ (Number\_of\_Firms\_in\_Industry) + \beta 6\ log\ (Number\_of\_Firms\_in\_Region) + \beta 7\ L\_SxLD + e$$

Where

B0 is the model's intercept while the coefficients of the independent variables are represented by B1 to B7. Log (Competitiveness_Score) represents the natural logarithmic transformation of the dependent variable. Log (Firm_Size) is the log

transformation of Firm Size, log (Firm_Age) – log transformation of Firm Age, log (Number_of_Firms_in_Industry) – log transformation of the Number of Firms in their respective Industries in the sample and log (Number_of_Firms_in_Region) - log transformation of the Number of Firms in the Region. Country_Dummy (CD) indicates the binary variable for country, with 1 representing Hungary (HU) and 0 representing Czech Republic (CZ), while Location_Dummy (LD) represents the binary variable for location, with 1 for urban and 0 for rural locations. L_SxLD represents the interaction term between the log-transformed Firm Size and the Location Dummy while e is the error term.

Table 7 shows the results of model progression from model 1 through to 4 estimated by sequential addition of variables to capture their impacts on the dependent variable. There is slight improvement in the models as seen in their respective R squared statistic, indicating modest improvements in the model's explanatory ability through the progression.

*Table 7.* Model progression of aggregate estimation

| | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| const | 1.51*** (0.06738) | 1.51*** (0.06839) | 1.47*** (0.14250) | 1.46*** (0.14274) |
| l_Firm_Size | 0.12*** (0.015761) | 0.12*** (0.01582) | 0.12*** (0.01603) | 0.12*** (0.02099) |
| l_Firm_Age | −0.07*** (0.02477) | −0.07*** (0.02488) | −0.06*** (0.02465) | −0.06** (0.02482) |
| Country Dummy: 1=HU, 0=CZ | −0.05* (0.03049) | −0.05 (0.03186) | −0.06 (0.03978) | −0.06 (0.04076) |
| Location Dummy: 1=Urban; 0=Rural | | −0.007 (0.03248) | −0.012 (0.03277) | 0.006 (0.09108) |
| l_Number_of_Firms_in_Industry | | | −0.02 (0.04186) | −0.02 (0.04217) |
| l_Number_of_Firms_in_Region | | | 0.03 (0.01314) | 0.03** (0.01323) |
| L_SxLD (interaction of Firms size and LD) | | | | −0.008 (0.03202) |
| *R-Squared* | *0.1552* | *0.1553* | *0.1716* | *0.1718* |
| *F-Statistic* | *(3, 327) =18.89*** | *(4, 326) =14.14*** | *(6, 324) =10.46*** | *(7, 323) =8.98*** |
| *AIC* | *88.18* | *90.13* | *87.7* | *89.62* |
| *SIC* | *103.39* | *109.14* | *114.13* | *120.1* |

*Source:* own construction in Gretl software reformatted for readability
*Note*: Dependent variable: l_Competitibeness_Score; Heteroskedasticity-robust standard errors, variant HC1. *N = 331, SE in parenthesis*

Both firm size and age are consistently significant throughout the model progression (models 1 to 4), with firm size positively associated and firm age negatively associated with competitiveness scores. The positive association between firm size and compositeness suggests that as firms grow, their competitive position

increases, possibly due to greater resource accumulation underscoring the importance of scale expansion that leads to economies of scale (Acs–Audretsch 1987). Conversely, the negative association between firm age and competitiveness is suggestive of the challenges older firms are exposed to in maintaining flexibility and adapting to competitive trends, thus emphasizing the importance of innovation (Coad et al. 2016).

Model 1 also shows that firms in Hungary are less competitive than those in the Czech Republic, as indicated by the negative coefficient of the Country Dummy variable. However, the significance of this association diminishes as more variables are included. This is consistent with studies that have indicated the importance of firm-specific factors over broad geographic characteristics (Porter 1998a). The results suggest that the Location Dummy variable does not have a significant effect, indicating that firm competitiveness is not differentiated by Urban–Rural location in this case. This could be due to the well-developed and balanced conditions that support firm activities in both Hungary and the Czech Republic, as they are developed countries.

The number of firms in regions measuring agglomeration has a positive and statistically significant effect, suggesting that firm agglomeration in regions fosters competitive effects. This could be due to a range of reasons, including knowledge spillovers, a more robust supply chain, and other agglomeration economies. Furthermore, the results suggest that the effect of company size on competitiveness is similar in both urban and rural areas, as demonstrated by the coefficient of the interaction term.

4.2.1. Country comparison

Table 6 shows the country comparison between Hungary and Czech Republic based on their specific sample. Similar cross-sectional analysis specified as follows is used:

*Generalized Equation for Model 3*

– For Hungary:

$$log\ (Competitiveness\_Score)\ HU = B0 + B1log\ (Firm\_Size) + B2log\ (Firm\_Age) + B3Location\ Dummy + B4L\_SxLD + B5log\ (Industry\_Share) + B6log\ (Number\ of\ Firms\ in\ Region) + e$$

– For Czech Republic:

$$log\ (Competitiveness\_Score)\ CZ = \gamma 0 + \gamma 1log\ (Firm\_Size) + \gamma 2log\ (Firm\_Age) + \gamma 3Location\ Dummy + \gamma 4log\ (Industry\_Share) + \gamma 5log\ (Number\ of\ Firms\ in\ Region) + e$$

Where:

β0 and γ0 are the constant terms for Hungary and the Czech Republic, respectively, B1 and γ1 are the coefficients for log-transformed Firm Size in each country, B2 and γ2 represent the coefficients for log Firm Age, B3 and γ3 denote the coefficients for the Location Dummy variable (1 for urban, 0 for rural), B4 and γ4 are

the coefficients for the interaction term between firm size and location dummy (L_SxLD), B5 and γ5 are the coefficients for the log of Industry Share and B6 and γ6 indicate the coefficients for the log Number of Firms in Region. e is the error term

*Table 8.* Cross-country analysis of Hungary and the Czech Republic

| | Hungary (N=199) | | | Czech Republic (N=132) | | |
|---|---|---|---|---|---|---|
| | *Model 1* | *Model 2* | *Model 3* | *Model 1* | | |
| const | 1.4*** (0.09247) | 1.4*** (0.10669) | 1.29*** (0.1663) | 1.66*** (0.10546) | 1.66*** (0.111) | 1.48*** (0.13759) |
| firm Size | 0.1*** (0.02461) | 0.1*** (0.03694) | 0.1*** (0.0381) | 0.13*** (0.02132) | 0.13*** (0.02617) | 0.13*** (0.02498) |
| l_Firm_Age | −0.03 (0.03067) | −0.03 (0.0315) | −0.03 (0.03083) | −0.14*** (0.04279) | −0.14*** (0.04292) | −0.12*** (0.04273) |
| Location Dummy: 1=Urban; 0=RuralD | −0.01 (0.04006) | −0.02 (0.13404) | −0.02 (0.1352) | −0.01 (0.05644) | −0.02 (0.1227) | 0.005 (0.12518) |
| L_SxLD | | 0.004 (0.04876) | −0.001 (0.05062) | | 0.004 (0.04076) | −0.001 (0.0417) |
| L_ Industry Share | | | 0.0302 (0.0457) | | | 0.02 (0.03277) |
| l_Number of Firms in Region | | | 0.0233 (0.03187) | | | 0.03** (0.01530) |
| *R-Squared* | *0.0794* | *0.0794* | *0.0835* | *0.2864* | *0.2865* | *0.3213* |
| *F-Statistic* | *(3, 195) =5.73*** | *(4, 194) =4.29*** | *(6, 192) =2.85*** | *(3, 128) =14.67*** | *(4, 127) =11.03*** | *(6, 125) =8.56*** |
| *AIC* | *67.22* | *69.22* | *72.33* | *23.04* | *25.03* | *22.43* |
| *SIC* | *80.4* | *85.68* | *95.38* | *34.57* | *39.45* | *42.61* |

*Source:* own construction

*Note*: Dependent variable: l_Competitibeness_Score. Heteroskedasticity-robust standard errors, variant HC1. *SE in parenthesis*

The findings show similarities in some elements and significant variations in others. The model progression demonstrates a continuous and statistically significant positive correlation between firm size (l_Firm_Size) and competitiveness score in both Hungary and the Czech Republic. This result highlights the importance of scale, as previously mentioned. Although both countries show a negative coefficient of firm age (l_Fim_Age), indicating a decrease in competitiveness among aging enterprises, this association is only statistically significant in the Czech Republic.

There is no significant effect observed for the Location Dummy variable or the interaction between firm size and location (L_SxLD) in the model progression for both countries. The sample suggests that firm competitiveness is not predicted by variations in urban–rural location. The interaction term is similarly insignificant suggesting that the impact of firm size on competitiveness does not vary between urban and rural settings.

In the case of Hungary, industry Share in which the firms belong and Number of Firms in Region show a positive but insignificant association with competitive sores. The absence of significant competitive effect of industry share (size) which essentially measures concentration, potentially points to heterogeneity off firms within industries. In contrast, for the Czech Republic, the number of firms in the region becomes significant in Model 3, indicating a positive relationship between regional firm density and competitiveness, suggestive of the presence of agglomeration economies in the Czech context.

## 5. Discussion

The aim of this study has been to explore the relationship between firm characteristics, geographical location and firm competitiveness in the context of SMEs in Hungary and the Czech Republic, aligning with the Resource Based view of the firm and the configurational approach. The study explores the impact of firm size as represented with the number of employees, age, geographical location on competitiveness alongside the effects of regional firm density and the urban rural dichotomy. The findings bring to fore an intricate relationship between the variables.

The models estimated show a positive association between firm size and competitiveness, which aligns with the Resource-Based View (RBV) assertion that a firm's resources, including its scale, contribute to its potential to achieve a competitive advantage (Barney 1991). This highlights the role of a firm's scale in boosting its capacity to leverage economies of scale and resource accessibility (Porter 1990). A growing number of employees in a firm can increase the talent and ideas pool, which can result in the promotion of innovation. Conversely, there is a negative association between firm age and competitiveness, which suggests that older firms may face bottlenecks in responding to market dynamics. This is consistent with Hannan and Freeman's (1984) view that, as organizations age, their propensity to adopt change diminishes, leading to higher levels of organizational inertia and slower reaction times compared to younger firms. To navigate this challenge, continuous innovation efforts can be pursued.

The significance of the country dummy diminishes as the model progresses in the aggregate estimation, aligning with Krugman's (1992) geographical economics assertions. This emphasizes the superiority of firm-specific factors over geographical determinants in influencing competitiveness. However, the positive association between the number of firms in a region and firm-level competitiveness validates the evidence of the competitive effect of regional firm agglomeration, which is consistent with Porter (2000) perspective. Agglomeration economies may arise from various factors, such as knowledge spillovers, innovation, and resource pooling.

Contrary to previously held views, this study does not confirm the view that urban–rural location is a significant driver of firm competitiveness. Scott and Storper (2003) suggest that firms located within dense networks in urban areas have advantages such as convenient access to resources, information, and collaborations, which contribute to improved productivity. However, the insignificant effect of location, together with its interaction with firm size, in the context of this study may

indicate the presence of developed regional infrastructure in the two countries that does not significantly distinguish between urban and rural areas.

## 6. Conclusion

Based on the empirical evidence and subsequent analysis presented in this paper, a number of policy recommendations can be deduced. Given the notable disparities in the impact of business characteristics, specifically age and size, on firm competitiveness in Hungary and the Czech Republic, it is reasonable to propose the implementation of tailored policies with the objective of promoting competitiveness. Both Hungary and the Czech Republic can derive more advantages by implementing policies that offer incentives to increase the size of their firms, considering the strong and positive correlation between firm size and business competitiveness. Although the age of a firm does not have a substantial impact on competitiveness in Hungary, the Czech Republic has the potential to mitigate this negative affect by implementing policies that foster continuous innovation. One such policy may involve the establishment of innovation centers that cater to firms with low inertia. Furthermore, due to the notable positive impact of regional firm concentration in the Czech Republic, the implementation of policies that promote cluster formation, networking, and partnerships could potentially yield advantages in fostering the growth of agglomeration economies. Furthermore, although the urban-rural split did not indicate substantial distinction, it does not undermine the significance of blanked regional development programs. The potential lack of significance in the influence of this variable in the present study may be attributed to unobserved factors, as prior research has demonstrated the impact of location (Scott–Storper 2015, Storper–Venables 2004).

In summary, this study has demonstrated the impact of business attributes and geographical variables, while also shedding light on the potential intricacies of this association through the comparison of Hungary and the Czech Republic. In addition to emphasizing the importance of implementing policies tailored to specific contexts, even in regions with similar socio-economic characteristics, as observed in the two countries examined in this study, the results indicate the necessity for firm strategies to surpass the examination of general factors like company size and age. Instead, firms should take into account the specific economic, industrial, and regional contexts when making decisions.

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