A system dynamics approach for assessing business competitiveness

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Abstract:
The analysis of the interconnectedness between resources and capabilities, and the way organizations use them as competitive weapons have become a central element of the strategic management literature. Drawing on the resource-based view and the configuration theory, this study proposes a multidimensional competitiveness index formed by ten competitive pillars that incorporates system dynamics in the analysis. Using a unique sample of 625 Hungarian small and medium-sized firms, we empirically illustrate how the proposed index functions for managerial decision-making. Results show that the impact of competitiveness-enhancing strategies is conditional on the configuration of the businesses' system of competencies. Low-competitive businesses benefit more from investments in the weakest competitive pillar, while strategies oriented to improve more than one competitive pillar yield higher competitiveness improvements among high-competitive businesses.

Keywords: Competitiveness, resource-based view, system dynamics, small business.

JEL codes: L25, L19

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1. Introduction

A central idea in the resource-based view of the firm (RBV) is that businesses acquire or develop specific resources and capabilities that interact with the existing ones for creating competencies as they pursue competitiveness and, consequently, superior performance (Prahalad and Hamel 1990, Barney 1991, 2001). Competitiveness is a construct linked to the development of a competitive advantage, and is often conceptualized as the capacity of the organization to efficiently amalgamate its resources and capabilities seeking to create value-adding competencies (Man et al. 2002, Barney and Mackey 2005).

Nevertheless, organizations do not realize the generally positive effects of investments in specific resources of capabilities at the same intensity (see e.g., Newbert 2007). Arguments rooted in the RBV frame emphasize that businesses with superior structures maintain their competitive edge on the basis that their resources and capabilities are not easily duplicable or surpassable (Barney 2001). Additionally, businesses pursuing a competitive advantage must also demonstrate the ability to alter available resources so that their potential can be fully exploited (Mahoney and Pandain 1992, Peteraf 1993, Barney and Mackey 2005). Therefore, the heterogeneous distribution of resources and capabilities among competing firms contributes to explain both the differences in business endowments and the dissimilar ability of businesses to create a resource-based competitive advantage. The analysis of how the associations between resources and capabilities condition business competitiveness is the focus of this study.

This paper proposes a managerial tool to evaluate business competitiveness. Specifically, our measure reflects the multidimensional nature of competitiveness by connecting the resource-based view and the configuration theory in a model that considers the mutual dependence of resources and capabilities in shaping organizational competitiveness.

Competitiveness is an attractive concept characterized by its long-term orientation, controllability and dynamism (Barney 1995, Man et al. 2002). The construct competitiveness has been analyzed from multiple angles. Previous research has mostly assessed competitiveness using aggregate estimates that capture the contribution of different resources and capabilities to competitiveness or (e.g., Hult et al. 2007, Fernhaber and Patel 2012, Hansen et al. 2013).

Despite the rigorous efforts, underlying studies on competitiveness are methodological approaches that ignore the different interactions that might exist between the variables that form business competitiveness. To address this issue, we propose a competitiveness index based on a system dynamics model that incorporates into the analysis system-level constraints between the analyzed resources and capabilities. Building on RBV theory postulates, competitiveness is defined as the mutually dependent bundle of resources and capabilities that allow the creation or development of valuable competencies (Prahalad and Hamel 1990, Barney 2001). Accordingly, the proposed competitiveness measure is formed by 46 variables grouped in ten competitive pillars—human capital, product, domestic market, networks, technology, decision making, strategy, marketing, internationalization, and online presence—which represent different resources and capabilities available for organizations.

Furthermore, we show how the proposed managerial tool functions for assessing business competitiveness by analyzing the responsiveness of the competitiveness index to changes in competitive pillars at the business- and industry-level. Additionally, a supplementary analysis examines the relationship between the competitiveness index and business performance metrics, namely employment growth and labor productivity. The empirical application considers a sample of 625 Hungarian SMEs operating in manufacturing, retailing, and professional services sectors during the period 2010-2013. This setting provides an opportunity to assess how different competencies contribute to business competitiveness in contexts where the interactions between resources and capabilities are complex and heterogeneous.

This article extends the existing literature on competitiveness in two main ways. First, drawing on the RBV and the configuration theory frames, our comprehensive competitiveness measure employs an index methodology that allows multiple interactions between the different pillars

that shape competitiveness, and takes into account the potentially restraining impact of bottleneck pillars on the system's performance. To the best of our knowledge, this is the first study that assesses competitiveness from a systemic perspective.

Second, decisions related to resource- or capability-enhancing actions have important economic, strategic and operational implications for organizations. Existing literature suggests that organizations that couple resource acquisition policies with the development of capabilities show superior results (e.g., Hult et al. 2007, Fernhaber and Patel 2012). We show how an analysis based on our competitiveness measure helps unveil the effects of competitiveness-enhancing actions in organizations with different system configurations, in terms of resources or capabilities. By connecting the RBV and the configuration theory we contribute to further understand the drivers of competitiveness, which is critical for managerial decision-making processes. Additionally, the contribution of this study extends to the small business management literature. Small businesses show significant particularities in terms of organization, resource allocation, managerial styles, strategic choices and the way of competition (Porter 1998, Man et al. 2002). By examining the outcomes that flow from the creation or development of competencies from a system dynamics perspective, managers of small businesses might be in a better position to cope with potential liabilities of newness and smallness, and balance strategic investments with actions that contribute to capitalize on the organization's resources and capabilities.

The remainder of the paper is organized as follow. Section two presents an overview of the resource-based view theory and the existing literature on competitiveness. Section three introduces the competitiveness index in line with the theoretical underpinning. Section four describes the data and variables. Results are presented in section five, and section six offers the discussion and concluding remarks.

2. The resource-based theory of the firm and business competitiveness

2.1 The resource-based theory of the firm

Organizations seek to gain and develop bundles of knowledge and skills—capabilities—which enable them to employ their internal resources more effectively (e.g., capital, labor, and materials). Resource-based view (RBV) theorists propose that the associations resulting from connecting resources and capabilities—labeled competencies—contribute to enhance business competitiveness and subsequent performance (Wernerfelt 1984, Prahalad and Hamel 1990). The heterogeneous distribution of resources and capabilities among firms explains both the differences in business endowments and the dissimilar ability of businesses to create a resource-based competitive advantage (Barney 1991). Businesses with superior systems and structures achieve higher performance and maintain their competitive edge on the basis that their resources and capabilities are not easily duplicable or surpassable (Barney and Mackey 2005).

Existing research rooted in the RBV is extensive and has mostly evaluated two fundamental assertions of this theory: (1) that some resources and capabilities have the potential to enable businesses to implement valuable strategies, and (2) that such resources and capabilities can be a source of competitive advantage when they possess attributes that make their imitation costly (Newbert 2007). Prior studies offer strong support to RBV postulates (see, e.g., the comprehensive reviews of Barney and Arikan (2001) and Crook et al. (2008)).

Perhaps because of the difficulties of measuring competitiveness (Ketchen et al. 2007), most empirical studies have sought to evaluate the individual contribution of different resources or capabilities to performance (Newbert 2007; Crook et al. 2008). Underlying this approach is the assumption that competitiveness is evident in organizations whose resources and capabilities are positively correlated to performance. Organizations are a bundle of resources and capabilities and these ingredients do not work in isolation and, as Newbert (2008, p. 751) points out, 'it is unlikely that a firm's competitive position is solely attributable to any one specific resource or capability.' Instead, businesses pursuing a competitive advantage must demonstrate the ability to exploit their resources and capabilities in such a way that their full potential is realized (Sirmon et al. 2011).

Competitiveness is a complex and multidimensional construct and it should be evaluated from a holistic approach to better understand how organizations 'do business' (Barney 1995). The core of our analysis is to match resources and capabilities with the creation of value-adding competencies,

while acknowledging the multidimensionality of competitiveness as well as the complementarities that exist between the business' resources and capabilities.

2.2 Competitiveness: competitive strengths and weaknesses

Competitiveness is linked to the development of a competitive advantage, and is often conceptualized as the capacity of the organization to amalgamate its resources and capabilities seeking to create value-adding competencies (Barney and Mackey 2005). Competitiveness is a multidimensional construct characterized by its long-term orientation, controllability and dynamism (Grant 1991, Barney 1995). Increased competitiveness allows organizations to create and implement valuable strategies that are hard to imitate by competitors and help to enhance profit margins (Porter and Millar 1985). Theoretical studies coincide in emphasizing both the complexity of measuring competitiveness and the strong relation between competitiveness and business performance in the long-run (Prahalad and Hamel 1990, Barney and Mackey 2005).

Studies building on the RBV show a great deal of variation in the resources and capabilities used to operationalize competitiveness, including organizational, operational, technological, customer-oriented and market-oriented variables. For example, variables related to the product/service and business operations are 'usual suspects' in competitiveness analyses (Douglas and Ryman 2003, Hult et al. 2007, Fernhaber and Patel 2012). Relevant competencies linked to human capital—e.g., accumulated knowledge stocks, knowledge acquisition and development of technical skills—have also received attention in the literature (Julien and Ramangalahy 2003, Aral and Weill 2007). Additionally, research has analyzed the role on competitiveness of various competencies related to internationalization (Lu and Beamish 2001, Belderbos and Sleuwaegen 2005), networking (Kingsley and Malecki 2004), marketing (O'Cass and Weerawardena 2010), and the business' strategic orientation (Hansen et al. 2013).

Recent technology advances, such as the rapid expansion of the Internet and the drastic decline in computing and communication costs, have allowed the development of IT-based competencies—e.g., use of ITs, database management and e-commerce deepening—which have drawn scholarly attention (Tippins and Sohi 2003, Aral and Weill 2007).

Among studies attempting to measure the competitiveness construct using factor analysis and structural equation models, a positive relationship is reported between competitiveness and a variety of performance measures, including: 1) accounting ratios such as return on assets, return on sales or cash flow margins (Zahra and Covin 1993, Douglas and Ryman 2003, Aral and Weill 2007), 2) export-oriented variables (Julien and Ramangalahy 2003), 3) performance constructs computed by factor analysis using financial and managerial variables (Tippins and Sohi 2003, O'Cass and Weerawardena 2010), 4) operating metrics related to cycle time (Hult et al. 2007), 5) growth in sales, employment and market share (Fernhaber and Patel 2012), and 6) shareholder's value (Hansen et al. 2013).

These studies provide widespread support to the notion that competitiveness is a multidimensional construct linked to resources and capabilities, and that competitiveness is positively correlated with performance. This line of thought is consistent with postulates of the RBV frame (Prahalad and Hamel 1990, Barney 1991, Eisenhardt and Schoonhoven 1996).

Existing studies also corroborate that the value of resources and capabilities for improving competitiveness is fully realized only when they are effectively capitalized (see, e.g., Hansen et al. 2004, Sirmon and Hitt 2009). This argument has fueled research rooted in the RBV which has mostly analyzed the effects on performance of various competencies (Crook et al. 2008, Sirmon et al. 2010).

Organizations capable of acquiring and exploiting a set of valuable competencies will achieve superior performance for two reasons. First, increased competitive strengths allow the business to react to changing market conditions in unique ways and satisfy more consumers (Douglas and Ryman 2003). Second, the positive effects that result from the complementarities between competitive strengths are documented in the literature (Crook et al. 2008). The complementarities between competitive strengths multiply the value that each can create for consumers, and allow businesses to improve the price/quality relationship of their products/services (Sirmon et al. 2010). Following these arguments, it seems logical that businesses with competitive strengths will achieve superior performance than businesses that, regardless of their competitiveness level, do not possess a solid set of competitive strengths.

H1: There is a positive relationship between business' competitive strengths and performance

At the business level, competitiveness is not only affected by the exploitation of valuable resource-capability combinations, but also by competitive weaknesses that might tamper the business' efforts for capitalizing on its available resources or capabilities. Competitive weaknesses represent the dark side of competencies, and different analytical approaches have been proposed within the RBV literature, including resource weaknesses, competitive disadvantage and strategic liabilities (West and De Castro 2001, Powell 2001, Arend 2004, Sirmon et al. 2010).

Literature on RBV emphasizes various factors that explain the negative effect of competitive weaknesses on performance. First, competitive weaknesses increase the business' vulnerability to changing market conditions or competitors' actions, which is detrimental to sales and, ultimately, performance (West and De Castro 2001). Second, businesses with clear competitive weaknesses have a lower possibility to pursue business opportunities (Sirmon et al. 2010). For example, lack of access to certain resources and capabilities—e.g., financial resources, human capital, networks—negatively affect the business' capacity to engage in new strategic actions linked to technology regeneration or internationalization.

Third, competitive weaknesses create a bottleneck of resources and capabilities that increases the business' unit cost by limiting the capacity to exploit other valuable competencies. For example, Douglas and Ryman (2003) show how skilled physicians are attracted to hospitals that offer cutting-edge technologies and deliver new services. Therefore, skilled people seek employment in organizations where their abilities are rewarded; while businesses using obsolete technologies will become unattractive to skilled employees, thus increasing the competitive weaknesses of the organization. Consequently, we hypothesize that competitive weaknesses create bottlenecks of resources and capabilities which negatively affect business performance.

H2: There is a negative relationship between business' competitive weaknesses and performance

2.3 The configuration of the system of competencies and performance: Harmonization of competitive pillars

So far we have hypothesized that competitive strengths and weaknesses shape business competitiveness and, consequently, performance. In each of these settings, simply examining the relationship between competitive strengths and weaknesses and performance might yield partial conclusions with regard to the RBV theory. Competitiveness is the result of having value-adding resources and capabilities (Peteraf and Barney 2003). Nevertheless, the effective exploitation of resources and capabilities is not only conditioned by their mere availability, but also by the ability of the organization to orchestrate its resources and capabilities seeking to enhance competitiveness.

Existing research has mostly adopted the net-effect logic to address the connections between resources and capabilities (Arend 2004, Ray et al. 2004, Sirmon et al. 2010). Underlying this approach in the assumption that competitiveness is a function of available competencies and that, regardless of the overall level of competitiveness, the configuration of competencies (strengths or weaknesses) determines business outcomes. The net-effect logic mostly focuses on the role of the dominant competitive force (strengths or weaknesses) on performance. By acknowledging the interconnectedness of resources and capabilities, we propose an alternative approach to competitiveness based on the configuration of the business' system of competencies.

We argue that the potentially positive value that a focal competency might create is not only a function of its availability or exploitation, but also depends on the configuration of the system of competencies within the organization. In the context of this paper, configuration refers to a multidimensional property that varies across organizations, and is defined as the degree to which organization's resources and capabilities are amalgamated and connected by a single theme (Miller 1996). Building on the configuration theory originally developed by Miller (1986, 1996), the elements of a system cannot fully be understood in isolation, so the analysis of the system as a whole is inevitable. While it is easy to copy a single element, the competitive advantage lies '…in the power of

the orchestrating theme and the degree of complementarity it engenders among the elements' (Miller and Whitney 1999, p. 13).

This argument is in line with RBV postulates. Organizations are a bundle of interconnected resources and capabilities (Powell 2001), and accurate analyses should take into account the role on competitiveness of both competitive strengths and weaknesses and the configuration of business competencies. For example, technology and knowledge are highly interconnected resources in professional service businesses, such as financial or knowledge-based consultancy firms. The use of obsolete technology might prove itself ineffectively when it comes to capitalize on human capital resources. Skilled employees will likely struggle with internal procedures in their day-to-day routines. In this example, and regardless of the overall business competitiveness level, poor technology implementation—i.e., in terms of software and hardware—creates a bottleneck that both limits the full exploitation of employees' knowledge and deteriorates both competitiveness and business operations. On contrary, the contribution of human capital to business competitiveness will increase as the organization harmonizes other competencies—i.e., technology—or develop competitive strengths.

Figure 1 illustrates the performance implications of the different configurations of competencies. Organizations can generate important gains from a relatively harmonized system of resources and capabilities. Businesses with a harmonized set of competencies can exploit their resource-capability combinations more efficiently, and performance will result from the value of their competencies. In the case of low-competitive businesses, a harmonized system of competencies might lack critical resources and capabilities that limit their capacity to implement value-adding strategies (Ferrier and Lyon 2004). Although the weak harmonization of competencies, these businesses are in a batter competitive position than businesses with a bottleneck of competencies caused by competitive weaknesses. For high-competitive firms, a harmonized set of competencies constitutes a source of competitive advantage and their effective orchestration contributes to develop strategic actions seeking to differentiate from competitors and, consequently, stimulate performance (Sirmon et al. 2010). In this case, strong harmonization will yield high performance levels.

--- Insert Figure 1 about here ---

Although their increased vulnerability to competitors' actions, businesses with a harmonized set of competencies are in a better position to exploit their resources and capabilities; therefore, their performance results are conditioned by the value of their competencies. Therefore, we hypothesize:

H3 (a): Among low-competitive businesses, a harmonization strategy leads to greater performance results compared to businesses with bottleneck competencies

H3 (b): Among high-competitive businesses, a harmonization strategy constitutes a source of competitive advantage that yields to superior performance results comparable to those generated by businesses with competitive strengths

In sum, competitiveness is a multidimensional construct which, to a large extent, results from a complex set of interactions between resources and capabilities. This is the focus on our study. This study seeks to contribute a deeper understanding of how businesses capitalize on their resources and capabilities and the systemic relations that exist between them. Building on the configuration theory, the following section describes the proposed competitiveness index which considers the system dynamics that emerge from the interactions of different competitiveness components.

3. A proposal for assessing business competitiveness

Organizations have different strengths and weaknesses, in terms of resources and capabilities, and their identification is critical because the key to a business' success or its future development lies in its ability to create or develop distinctive competencies (Teece et al. 1997).

Competitiveness has been operationalized in a number of different ways. Prior studies underline a number of firm-specific sources of competitiveness; however, previous attempts to measure competitiveness rely on either individual variables or the estimation of aggregate metrics in which the analyzed components individually contribute to competitiveness (see, e.g., Douglas and Ryman 2003, Aral and Weill 2007, O'Cass and Weerawardena 2010, Fernhaber and Patel 2012).

These measures capture the level of statistical association between the analyzed variables. Nevertheless, the analysis of competitiveness based on the estimation of aggregate metrics might prove itself ineffective in that they ignore the potential connections between the analyzed resources and capabilities. Based on these arguments and following the theory in section 2.3 we propose that:

Competitiveness is the mutually dependent bundle of ten pillars— human capital, product, domestic market, networks, technology, decision making, strategy, marketing, internationalization, and online presence—that allow a firm to effectively compete with other firms and serve customers with valued goods/services.

The selected competitiveness pillars match RBV postulates (see e.g., Wernerfelt 1984, Barney 1991, Peteraf 1993, Man et al. 2002), and their relevance flows from the recognition that multiple interactions that can take place within a business and that the nature and intensity of these interdependent relations affect competitiveness. Small and medium-sized enterprises (SMEs) are not scaled-down versions of large firms as the former group shows significant particularities in terms of organization, resource allocation, managerial styles, strategic choices and the way of competition (Porter 1998, Man et al. 2002). Small firms are faced with important resource constraints, thus increasing their vulnerability with respect to environmental changes and uncertainty. Although increased globalization, small firms mainly compete in domestic markets, a fact that implies the adoption of entirely different strategies compared to large firms (Tetteh and Burn 2001). Innovation is another variable frequently used to explain small firms' differentiating behavior (Malecki and Tootle 1996, Verhees and Meulenberg 2004). Small firms often lack resources which are particularly vital for their survival and performance (Bridge et al. 2003). As a result, networking, external collaborations and efficient knowledge-sharing channels are critical competencies (Eisenhardt and Schoonhoven 1996, Dyer and Singh 1998).

Various attempts made way for developing diverse competitiveness measures (see section 2). However, the multidimensional nature of the relations between the analyzed competencies has been mostly ignored in the literature. By interlocking the RBV with configuration theory postulates, we propose a four-step procedure to compute competitiveness.

To estimate the competitiveness index (*CI*), we first normalize in the [0,1] range all variables included in the analysis ($j=1,...J$) as:

$$x^*_{i,j} = \frac{x_{i,j}}{\max(x_j)}, \qquad j = 1,\ldots,J \text{ and } i = 1,\ldots,N \tag{1}$$

In equation (1) $x^*_{i,j}$ is the normalized value for the *jth* variable obtained for the *ith* business, while $x_{i,j}$ is the original value of the focal variable. The selected benchmarks $(\max(x_j))$ are, for each variable (*j*), the highest score and these proxy the best practices, while all remaining values are related to these benchmarks. In this study we use the distance normalization approach because, contrary to the *min-max* technique (mean of zero and variance of one), this approach preserves the observed relative difference among the analyzed businesses.

In the second step we propose to separate the vector of normalized variables (*J*) into 10 vectors (**v**) which correspond to the analyzed competitiveness pillars $(\mathbf{v} = (v_1,...,v_J) \in R^J_+)$. The pillar scores are the average value of the variables included in each pillar (**v**). Additionally, the values of the pillar scores are normalized in the [0,1] range to ease the interpretation of the results. To compute the normalized competitiveness pillar scores one must solve:

$$p_{i,v} = \frac{\sum_{k=i}^{K} x^*_{i,v}}{K}, \qquad v = 1,\ldots,10 \text{ and } k = 1,\ldots,K \tag{2a}$$

$$p^*_{i,v} = \frac{p_{i,v}}{\max(p_v)}, \tag{2b}$$

Note that the pillar scores $(p_{i,v})$ are computed for each firm (i=1,…,N) and that the number of variables used to estimate each pillar (k=1,…,K) might vary across pillars.

The third step considers the mutual dependence of the 10 competitiveness pillars by introducing a penalty for bottleneck in the estimation of the competitiveness index. Following the configuration theory (Miller 1996), improvements can be only achieved by strengthening the weakest link—the bottleneck—that constraints the performance of the whole system. Good performing pillars can only partially and not fully compensate poor performing pillars. This imbalance pulls back the competitive performance of the particular business. Mathematically, the penalty of bottleneck is modeled via a correction form of an exponential function of ae^{-bx} (Tarabusi and Guarini 2013). In this study the penalty function is defined as:

$$h_{i,v} = \min(p^*_{i,v}) + (1 - e^{-(p^*_{i,v} - \min(p^*_{i,v}))}) \quad (3)$$

where $h_{i,v}$ is the post-penalty value for the *vth* pillar and $\min(p^*_{i,v})$ is the lowest pillar value reported for the *ith* business. Equation (3) shows that, for each business and each pillar, the bottleneck penalty is obtained by adding one minus the base of the natural logarithm of the negative difference between the focal index pillar $(p^*_{i,v})$ and the lowest pillar value reported for that business (equations (2a) and (2b)).

Finally, in the fourth step we use results from equation (4) to estimate the competitiveness index (*CI*) for each firm as the sum of the ten pillars as follows:

$$CI_i = \sum_{v=1}^{10} h_{i,v} \quad (4)$$

Keep in mind that the penalty for bottleneck approach (equation (3)) is particularly suitable for portraying the dynamics of business competitiveness. For illustrative purposes, suppose that a fictitious business has the following unadjusted pillar values (equations (2a) and (2b)): human capital = 0.80, product = 0.75, domestic market = 0.70, networks = 0.75, technology = 0.40, decision making = 0.72, strategy = 0.67, marketing = 0.74, internationalization = 0.65 and online presence = 0.82. A traditional additive approach would yield a competitiveness score of 7.00. Yet, underlying this calculation is the assumption of full substitutability of the competitiveness pillars, which is not a realistic representation of systemic phenomena where the substitutability between system pillars may vary. This concern is addressed by considering the systemic relations through the penalty for bottleneck approach in the estimation of the competitiveness index. In the proposed example the bottleneck pillar is technology (0.40), and by solving equation (3) the post-penalty pillar values are computed. For instance, the final value of the human capital pillar is 0.73 $(h_{i,v=1} = 0.40 + (1 - e^{-(0.80-0.40)}))$. The post-penalty values of the rest of the system pillars can be computed analogously, and the resulting competitiveness index is 6.54 instead of 7.00 (equation (4)).

This simplified example illustrates the problem with the assumption of full substitutability of index components. Businesses with poor or obsolete technology might not effectively capitalize on their human capital as employees will likely struggle with internal procedures in their day-to-day routines, which limits the full utilization of their knowledge and deteriorates business operations. In line with the example, if the organization improves its technology pillar by 10 index points (0.10)—e.g., through specific investments—the competitiveness index would increase 32 index points (4.94%) from 6.54 to 6.86. To sum up, the penalty for bottleneck method accounts for the partial substitutability between system components, and its inclusion in the analysis increases the capacity of our index to measure competitiveness.

Note that in our approach to competitiveness, 1) bottleneck competencies dilute the contribution of other valuable competencies, 2) improvements in bottleneck competencies represent a costly investment, 3) the harmonization of competencies is a source of competitive advantage linked to the exploitation of homogeneously distributed resources and capabilities, and 4) the development of competitive strengths leads to superior performance. The proposed systemic approach to competitiveness is a valuable managerial control tool which not only unveils business weaknesses and

their effect on competitiveness, but also captures the multiple relationships that exist among the analyzed competitiveness pillars.

4. Empirical illustration: Data and variables used to build to competitiveness index

4.1 Data

For the empirical illustration we use a unique primary dataset drawn from a research project on competitiveness of Hungarian enterprises supported by the European Union (TÁMOP 4.2.2 A–11/1/KONV-2012-0058). Data were collected specifically for the purpose of this study and the process was entirely supervised by a team of the Faculty of Business and Economics at the University of Pécs (Hungary).

The selection process of the surveyed firms was two folded. First, we selected a random sample of firms from the OPTEN company database. The OPTEN database includes all businesses registered in the Hungarian Business Registry. From this dataset nearly 9,500 firms were selected according to size, industry and geographic quotas. In the context of this study, top managers are a relevant respondent group. Therefore, and after an initial telephone call for approval, in the second step a face-to-face interview was carried out to one of the business owners (only if he/she is in top management team) in the case of firms smaller than 20 employees, while for businesses larger than 20 employees a top executive—irrespective of whether the executive has ownership rights or not—was interviewed. The data collection process was achieved through self-administrated, structured interviews where managers were asked to answer essentially close questions. The survey was conducted by a professional market investigation firm, and the information was collected between March and June 2013. The questionnaire was subject to a pre-test to correct potentially misleading or confusing questions.

A total number of 662 surveys were obtained (response rate: 6.98%). Yet, in the interest of following a rigorous methodology, only observations for which a complete dataset of the analyzed variables could be constructed were included. Thus, we excluded 37 businesses with incomplete data. This yielded a final sample of 625 businesses. The average business has 26 employees with 15 years of market experience. Also, the analysis of the industry configuration of the final sample reveals that 32% of firms operate in manufacturing sectors, while the proportion of retailing and professional services businesses is 40% and 28%, respectively. We tested non-response bias for early and late respondents in terms of business size (employees), business age and sales across the analyzed industry sectors. We found no significant differences.

Additionally, data on sales and assets were obtained from official publicly available sources of the Hungarian Ministry of Justice.[1] Based on the unique identification code available from the questionnaire, information was collected for the sampled businesses during the period 2010-2013. Data available allow at computing two performance metrics: employment growth between 2010 and 2013, and labor productivity measured as sales divided by employees. This information was used to carry out the regression analysis linking competitiveness to business outcomes. Details on this analysis and its results are presented in section 5.2.

4.2 Variables used to estimate the competitiveness pillars

To compute the competitiveness index we employed two groups of variables. The first set of variables deals with different resources and capabilities, while the second group of variables captures changes in these variables between 2010 and 2013. Similar to Irwin et al. (1998) and Douglas and Ryman (2003), respondents were asked along a five-point scale to value the individual importance of a series of resources and capabilities. These resources and capabilities are only valuable if deemed so by the respondents (Priem and Butler 2001). In the proposed Likert-type scale a value of '1' designates a low relevant variable, while a value of '4' represents a highly relevant variable. The value of '0' indicates that the focal resource or capability has no strategic value whatsoever (Douglas and Ryman 2003), and the remaining points of the scale ensure the uniform evaluation and quantification of the variables' importance. Also, the division of the positive scale values (from '1' to '4') allows a sufficient degree of differentiation in the valuation of the analyzed variables (Lederer et al. 2013).

[1] Data are available at http://www.e-cegjegyzek.hu/index.html

It should be kept in mind that, to ease readability for respondents, the coding of some variables was modified as a result of the nature of the questions. In the case of the human capital pillar, numerical values were used to codify the educational attainment of employees (number and share of employees with higher education degree) and the proportion of employees actively participating in training programs. Similarly, the weight of new product in the business' sales is introduced in the product pillar, while the number of cooperation and innovation agreements was used in the computation of the networks pillar. The strategy pillar includes the number of business units as a proxy variable for the growth strategy of the business. Finally, the proportion of sales in foreign markets was included in the internationalization pillar.

Therefore, from our questionnaire it is possible to obtain information for 46 variables related to the ten competitiveness pillars (competencies) analyzed in this study. The description of the variables used to build the competitiveness pillars are presented in the Appendix (Table A1). The post-penalty values of the competitiveness pillars are computed, for each business, by solving equations (1)-(3), and these values are introduced in equation (4) to estimate the competitiveness index. Descriptive statistics for both the normalized pillar values estimated from equation (3) and the competitiveness index (equation (4)) are presented in Table 1.

--- Insert Table 1 about here ---

In line with the literature review presented in section 2.2, one would be tempted to question whether the selected variables (Table A1 in the Appendix) measure the corresponding competencies, and whether the analyzed pillars accurately represent the competitiveness construct. To further corroborate the appropriateness of the variable selection process, a robustness check was carried out based on the estimation of a principal component factor analysis that evaluates how well the 46 observed variables reflect the ten pillars used to build the competitiveness index. Results in Table A2 of the Appendix reveal that the reliability test (Cronbach's alpha) for the ten competitiveness pillars ranges between 0.6451 (marketing) and 0.8623 (online presence). This result confirms that the constructs extracted from the factor models are internally consistent across the analyzed variables to measure the competencies under evaluation (Nunnally and Bernstein 1994). A second factor model verifies whether the analyzed pillar values measure competitiveness. The results for the factor model corroborate that the selected pillars efficiently measure the competitiveness construct (Table A2).

5. Results

To corroborate the usefulness of the proposed competitiveness index for managerial purposes, the analysis presented in this section focuses on how our managerial tool functions. More concretely, we first show how managers can employ the competitiveness index to determine the potential impact of changes in competitive pillars over business competitiveness. This analysis represents an ideal illustration of how the proposed competitiveness index can be used for managerial purposes. To test the study hypotheses, the second stage analysis presents the results of the regression analysis relating the proposed competitiveness index to employment growth.

5.1 Competitiveness assessment

In managerial settings it makes sense to benchmark against best practice peers, and organizations often imitate best practices in the industry to enhance their competitiveness and, consequently, their performance level (Kaplan and Atkinson 2000). The benchmarking literature emphasizes that managerial best practices used as targets for control should be relevant, attainable and—to the possible extent—observable (Camp 1995).

The results of the competitiveness index have managerial interpretations not only due to the benchmarking for monitoring business activities, but also because current results become objectives for managerial control in the near future (Grant 2008). We scrutinize the responsiveness of the competitiveness index to improvements in different pillars at the business level. More concretely, we analyze the effects on competitiveness of employing additional recourses to improve the bottleneck pillar, the two weakest pillars and strong pillars. This business-specific interpretation of the competitiveness index is of crucial importance for business analysis. Keep in mind that, for simplicity,

underlying this analysis are the assumptions that the cost of additional resources is the same for all pillars; and that additional resources are equally available for all organizations.

To illustrate the functioning of the proposed index, Table 2 presents two cases extracted from the dataset used in this study in which available additional resources—equivalent to 0.10 index points—are employed to improve 1) the bottleneck pillar, 2) the strongest penalized pillar, and 3) the two lowest pillars by a combined amount of 0.10 index points.

The first example refers to a business with a low competitiveness level and a clear bottleneck pillar. In this case, an increase in 0.10 index points in the bottleneck pillar (online presence) enhances the business' competitiveness score by 11.33% (0.20 points) from 1.81 to 2.01. Note that if the organization uses the resources to improve the strongest pillar (human capital), competitiveness only increases 4.20%. Additionally, if the business adopts a harmonization strategy and employs the additional resources to improve the two weakest pillars (online presence and networks), the reported improvement in the competitiveness index is 8.77%, a value which is lower than that reported for the bottleneck-improvement strategy. These results might signal that competitiveness enhancing actions of poor performing businesses should be more aligned with actions that improve the weakest (bottleneck) pillar. The proposed managerial tool might prove itself useful in that it can contribute to improve managers' decision-making and to efficiently allocate resources that seek to enhance competitiveness.

--- Insert Table 2 about here ---

The second example in Table 2 presents a high-performing business with a more balanced competitiveness system. Results indicate that a harmonization strategy linked to the improvement of more than one weak pillar (human capital and domestic market) produces the greatest improvement in competitiveness (1.70%), relative to the increase that results from improving the bottleneck pillar (1.54%). Therefore, for high-performing businesses, managers should value harmonization strategies that seek to improve the business' competitiveness level.

5.2 The relationship between the configuration of the competitiveness system and performance

The analysis in section 5.1 shows how organizations might improve their competitiveness level by investing in internal resources and capabilities. In addition to possessing these ingredients, the RBV theory emphasizes the exploitation of valuable competencies based on rare, and hard to imitate resources and capabilities to confer competitive advantage (Barney 1991). Underlying this argument is the assumption that businesses orchestrate their competencies in such a way that their performance metrics are maximized (Mahoney and Pandain 1992, Peteraf 1993). In the context of this study, this implies that performance variations might be explained by differences in competitiveness and by differences in the configuration of the competitiveness system. Therefore, the analysis presented in this section tests the relationship between competitiveness, the configuration of the system of competencies and performance by estimating the following linear regression model:

$$\begin{aligned}\text{Employment growth}_i = {} & \beta_0 + \beta_1 \text{Competitiveness}_i + \beta_2 \text{Configuration of competitiveness system}_i \\ & + \beta_{12} \text{Competitiveness} \times \text{Configuration of competitiveness system}_i \\ & + \beta_3 \text{Control variables}_i + \varepsilon_i\end{aligned} \quad (5)$$

In equation (5) $\boldsymbol{\beta}$ is the vector of coefficients for the independent variables and ε_i is the normally distributed error term. Concerning the dependent variable, business growth is a critical outcome for small business and it can be measured in many ways, including sales, assets or employment (Davidsson et al. 2002). However, Davidsson et al. (2006, p. 8) conclude that growth metrics based on employment show the highest correlation with alternative growth indicators (sales and assets). Following Davidsson et al. (2002), employment growth is measured as $(\text{Employment}_{i,t} - \text{Employment}_{i,t-c}) / [(\text{Employment}_{i,t} + \text{Employment}_{i,t-c}) / 2]$ to obtain an asymptotically normally distributed variable between 2010 (c) and 2013 (t).

To test the proposed hypotheses we used a set of dummy variables to identify businesses showing competitive strengths, competitive weaknesses, or a harmonized competitiveness system. To ensure estimation accuracy we first obtained, for each business, the skewness of the reported competitive pillars. The skewness statistic indicates how symmetrically distributed is a set of observed values (Greene 2003, p. 879). The analysis of the role of the configuration of the system of competitiveness on performance is of interest in this study, and this variable contributes to reveal the configuration of competitive pillars. Regardless of their competitiveness score, businesses were grouped according to the configuration of their competitiveness system as follows. A symmetrical distribution ($-1 <$ skewness < 1) indicates that competitive pillars are harmonized. A left skewed result (negative skew: < -1) points to a concentration of values on the right tail of the distribution, which points to the presence of bottleneck competitive pillars. A right skewed distribution (positive skewness: > 1) suggests that pillars are highly concentrated in the left tail of the distribution of competencies, that is, few high-performing pillars shape competitiveness (competitive strengths). This grouping approach allows for a strong degree of differentiation, in terms of the configuration of the competitiveness system. Additionally, a reasonable number of businesses fall into each of the categories (bottleneck = 225 businesses, harmonization = 316, competitive strengths = 84).

To further explore the relationship between the configuration of the competitiveness system and performance, we employed a median split along the competitiveness score of the sampled businesses to test for performance differences among businesses, according to the configuration of their system of competitiveness. By introducing interaction terms between the competitiveness level (below- and above-the median) and the dummy variables linked to the configuration of the competitiveness system we identified businesses represented in the four areas presented in Figure 1.

We control for size, age, industry and location. As in Davidsson et al. (2006), we use the number of employees in the base period (in our case, 2010) to analyze the relationship between size and growth. Business age is expressed in years. The variables size and age were logged to reduce skewness. A set of dummy variables were used to control for industry effects (manufacturing, retailing and professional services). Following the NUTS-2 criterion Hungary is divided in eight regions: Budapest, Central Hungary, Central Transdanubia, Western Transdanubia, Southern Transdanubia, Northern Hungary, North Great Plain, and South Great Plain. Thus, a set of dummy variables accounting for the location of the business were introduced in the models. Regression models were estimated via OLS. Descriptive statistics for the study variables are presented in Table 3.

The regression models relating competitiveness and performance are depicted in Table 4. To address the threat of collinearity, we computed the average variance inflation factor (VIF) for all variables (Greene 2003). In all models, the average and highest VIF values do not exceed the generally accepted rule of thumb of 10 for assessing collinearity. The results for this diagnostic test do not raise collinearity concerns. Specification 1 in Table 4 is the baseline model testing the relationship between the competitiveness index and growth. Models 2 to 4 show the results for the effect on performance of each of the variables related to the configuration of the competitiveness system. Models 5 and 6 evaluate the performance effects of the configuration of their competitiveness system (the reference category is the group of businesses with bottleneck pillars).

--- Insert Tables 3 and 4 about here ---

The findings show that the systemic competitiveness index significantly explains performance differences among the sampled businesses. For example, from Model 1 we find that, ceteris paribus, the estimated change in employment growth resulting from a one unit increase in the competitiveness index is 9.61 percentage points (*t-value* = 5.03 and *p-value* < 0.001). Hypothesis 1 proposes a positive relationship competitive strengths and performance. Results in Model 2 confirm this hypothesis. Irrespective of the competitiveness level, employment growth raises 21.10 percentage points in businesses with a set of competitive strengths, relative to the rest of businesses. Additionally, firms with solid competitive strengths experience a rate of employment growth 27.39 percentage points greater than that of businesses with bottleneck competitive pillars (Model 5).

Results in Model 4 provide support to Hypothesis 2 that proposes a negative relationship between competitive weaknesses and performance. In this case, the findings indicate that the

employment growth of businesses with competitive weaknesses is 15.60 percentage points lower than that of businesses with competitive strengths and a harmonized competitiveness system.

The results for the test of Hypotheses 3(a) and 3(b) are presented in Model 6 of Table 4. Based on the results from Model 6, Figure 2 displays the estimated average employment growth rate for the sampled businesses according to their level of competitiveness (below and above the median) and to the configuration of the competitiveness system (bottleneck pillars, harmonization and competitive strengths).

--- Insert Figure 2 about here ---

Hypothesis 3(a) proposes that, among low-competitive businesses, a harmonization strategy leads to greater performance results compared to businesses with bottleneck competencies. Results estimated from Table 4 and presented in Figure 2 do not support this hypothesis. The findings reveal that the estimated average growth rate in low-competitive businesses with a harmonized competitiveness system (1.57%) is not significantly different from that computed for businesses with clear bottlenecks pillars (–2.33%) (*t*-test = 0.69, *p-value* = 0.49). Additionally, note that the estimated average growth rate in businesses with competitive strengths (6.77%) is significantly greater than that reported for businesses with a harmonized competitiveness system (*t*-test = 3.15, *p-value* < 0.01) and for businesses with bottlenecks pillars (*t*-test = 2.69, *p-value* < 0.01).

Hypothesis 3(b) states that, among high-competitive businesses, a harmonization strategy constitutes a source of competitive advantage that yields to superior performance results comparable to those generated by businesses with competitive strengths. Results do not support this hypothesis. In the group of high-competitive businesses, the estimated growth rate for businesses with a harmonized strategy (6.27%) is not significantly different than that estimated for businesses with clear competitive strengths (9.93%) (*t*-test = 1.46, *p-value* < 0.14). Additionally, high-competitive businesses with bottleneck pillars show the lowest estimated average employment growth rate (3.56%), and this result is significantly lower than the estimated growth rate reported by firms with a harmonized competitiveness system (and *t*-test = 1.71, *p-value* < 0.088) and by firms with a clear competitive strengths (*t*-test = 2.23, *p-value* < 0.027) (Figure 2).

Finally, we conducted two robustness checks to ensure estimation accuracy. First, we tested the potential non-linear effect of competitiveness on performance. Results (available on request) for the linear and squared term are not significant, thus indicating a linear relationship between competitiveness and the analyzed performance metrics. Second, we tested for the potential moderating effect of business size in the relationship between competitiveness and performance. In unreported results, available on request, we find that the interaction term between size and competitiveness is not statistically significant, while the sign and significance level of the coefficient of competitiveness remains unchanged.

6. Discussion, implications and concluding remarks

In this study, we adopt a system dynamics approach to develop a managerial tool for evaluating business competitiveness. Building on insights from the RBV theory and the configuration theory, competitiveness is conceptualized as a multidimensional construct that results from the mutually dependent associations between resources and capabilities (Prahalad and Hamel 1990, Barney 2001). Our comprehensive competitiveness measure employs an index methodology that takes into account both the multiple interactions between different competencies, and the potentially restraining effect of weak (bottleneck) competencies.

The novelty of our approach was to examine competitiveness from a systemic perspective rather than analyze the individual contribution of certain resources and capabilities. We show the usefulness and the informative power of the proposed managerial tool by revealing how the adoption of strategies oriented to improve different resources or capabilities contributes to enhance business competitiveness. Through the analysis of the business-specific results organizations can optimize the allocation of additional resources that seek to increase their competitiveness level.

Overall, the results of the empirical application show that the configuration of the organization's competitive system—in terms of resources and capabilities—conditions the generally positive impact of competitiveness enhancing actions linked to the acquisition of resources or the

development of capabilities. While competitiveness significantly improves in businesses that carry out specific investments targeting weak (bottleneck) competitive pillars, businesses with a more balanced system of resources and capabilities benefit more from a harmonization strategy that seeks to improve various competencies. Therefore, our competitiveness index might prove itself useful in providing critical information to improve strategic decision-making processes that attempt to enhance business competitiveness.

These findings have important implications for scholars and practitioners. Prior research on the RBV has addressed the contribution of different resources and capabilities to competitiveness through the individual analysis of relevant variables or factor analysis models (e.g., Douglas and Ryman 2003, Fernhaber and Patel 2012). Despite the rigorous efforts, aggregate measures of competitiveness obscure the performance implications of distinct resources and capabilities. Our results reveal that, when evaluated as a monolith, the positive association between competitiveness and performance is readily evident, when in fact different resources and capabilities might have conflicting performance implications. For example, low-competitive businesses benefit more from investments in bottleneck pillars, while a harmonization strategy seeking to improve various competitive pillars seems more appropriate for high-competitive businesses with a more balanced competitiveness system.

The proposed competitiveness measure matches RBV's postulates that emphasize the complexity of the associations between resources and capabilities with the need to accurately measure competitiveness from a holistic perspective. By adopting a system dynamics approach that both introduces multiple interactions between resources and capabilities and accounts for the boundaries of the competitiveness system, this study contributes to the development of the literature dealing with the determinants of competitiveness. Additionally, our focus on small businesses in an emerging economy contributes to expand the body or work dealing with competitiveness in developed economies (e.g., Hult et al. 2007, Hansen et al. 2013).

For the strategy practitioner our index might help to underscore the importance of giving the multidimensional nature of competitiveness a central role in strategic planning and implementation for optimizing specific investments. The proposed competitiveness measure has managerial implications not only due to the benchmarking for monitoring business activities, but also because current results become objectives for managerial control in the near future (Grant 2008). We suggest that managers need to turn their attention to the development of quantitative—including aspects dealing with operational and financial aspects—and qualitative metrics—including aspects related to strategy, product and online presence—when evaluating both competitiveness and the effectiveness of competitiveness-enhancing actions.

Resources and capabilities are heterogeneously distributed across businesses, which conditions the ability of managers to create a resource-based competitive advantage. Without a proper analysis of the system of competencies, businesses replicating competitiveness-enhancing actions adopted by industry peers would not necessarily achieve the same results. The results suggest that businesses need a balance between competitive pillars. Overemphasis on few competitive pillars does not guarantee long-term competitiveness, which can in turn result from multiple interactions of different competitive pillars. Businesses seeking to enhance competitiveness should first evaluate their competitive strengths and weaknesses. In this sense, the proposed competitiveness measure might represent the instrument to carry out this business-level analysis, and provide managers with valuable information that help direct future actions and investments to improve the business' competitive position.

It must, however, be mentioned a series of limitations to the present study that, in turn, represent avenues for future research. First, the data do not permit the direct analysis of the effect of improvements in resources or capabilities on competitiveness. We present various interpretations of how resource- and capability-enhancing actions impact business competitiveness; however, we do not evaluate how organizations internalize these investments into their operations, nor do we assess the trade-off between the cost of such investments and their subsequent effects on competitiveness. Further research on this issue would be valuable. For example, future studies should evaluate whether the process to amalgamate new resources of capabilities with existing ones condition competitiveness improvements within organizations. This issue suggests the need for more detailed data dealing with the effects of specific investments on competitiveness.

Second, future research should corroborate the robustness of the proposed index in other industry sectors and in public organizations which are exposed to external market pressures and whose managers tend to prioritize short-term profits over long-run strategic objectives (Fisman et al., 2014). Third, while we grouped 46 variables in ten competitive pillars, it is necessary to further validate the proposed competitiveness index and test whether additional competencies are relevant in certain market environments. From a strategic perspective, specifically designed future research can address this point by evaluating whether specific factors related to the entrepreneur(s) and to the market where the business operates—e.g., high-tech sectors or stock markets—have a differentiated effect on competitiveness. Finally, the geographic specificity of the study calls for obvious caution when interpreting and generalizing its findings.

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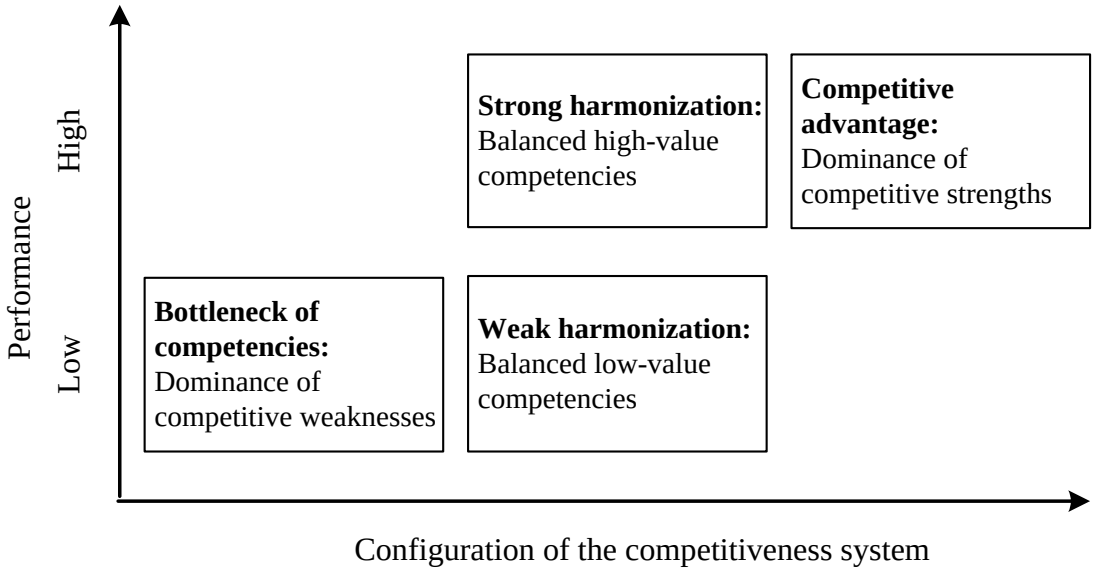
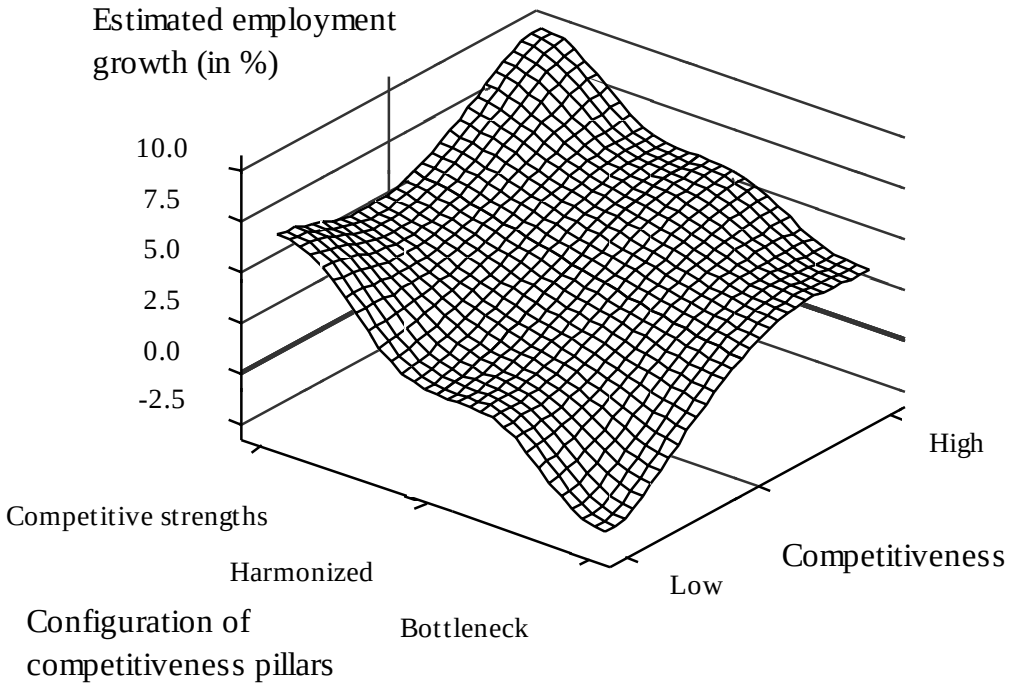
List of Figures

Figure 1. Response surface of competitiveness and the configuration of competitive pillars



Source: Authors' elaboration

Figure 2. Response surface of competitiveness and the configuration of competitive pillars



Source: Authors' elaboration

List of Tables

Table 1. Competitiveness: Descriptive statistics for the selected competitive pillars

	Mean	Std. dev.	Q1	Q3
Competitiveness index (*CI*)	3.8859	1.3438	2.8783	4.8244
Competitiveness pillars				
Human capital	0.3941	0.1446	0.2784	0.4863
Product	0.3926	0.1553	0.3062	0.4898
Domestic market	0.3889	0.1584	0.2715	0.4951
Networks	0.3838	0.1982	0.2590	0.5234
Technology	0.3918	0.1566	0.2784	0.4930
Decision making	0.3804	0.1961	0.2263	0.5271
Strategy	0.3817	0.1735	0.2693	0.4947
Marketing	0.3926	0.1572	0.2787	0.4838
Internationalization	0.3837	0.1926	0.2385	0.5269
Online presence	0.3962	0.2881	0.0200	0.6423

Number of observations: 625.

Table 2. Competitiveness index: Business-level results

	Example 1: poor performing business with a clear bottleneck					Example 2: high performing business				
			Improvement strategies					Improvement strategies		
	Normalized pillar values	Penalized pillar values	(1)	(2)	(3)	Normalized pillar values	Penalized pillar values	(1)	(2)	(3)
Human capital	0.2644	0.2404	0.2566	0.3162	0.2495	0.6191	0.6191	0.7156	0.6191	0.6689
Product	0.2252	0.2085	0.2214	0.2085	0.2161	0.6513	0.6508	0.6512	0.6508	0.6513
Domestic market	0.2066	0.1930	0.2042	0.1930	0.1997	0.6344	0.6343	0.6344	0.6343	0.6839
Networks	0.1437	0.1382	0.1437	0.1382	0.1882	0.7330	0.7268	0.7283	0.7268	0.7298
Technology	0.2353	0.2169	0.2306	0.2169	0.2248	0.7079	0.7041	0.7053	0.7041	0.7063
Decision making	0.2186	0.2030	0.2154	0.2030	0.2103	0.7030	0.6996	0.7007	0.6996	0.7017
Strategy	0.2071	0.1934	0.2047	0.1934	0.2002	0.6714	0.6701	0.6707	0.6701	0.6712
Marketing	0.2562	0.2338	0.2494	0.2338	0.2426	0.7125	0.7083	0.7095	0.7083	0.7107
Internationalization	0.1475	0.1416	0.1474	0.1416	0.1457	0.6594	0.6586	0.6591	0.6586	0.6594
Online presence	0.0369	0.0369	0.1369	0.0369	0.0869	0.8110	0.7937	0.7963	0.8723	0.7989
Competitiveness index		1.8057	2.0103	1.8815	1.9640		6.8652	6.9711	6.9438	6.9820
Improvement (index points)			0.2046	0.0758	0.1583			0.1058	0.0785	0.1168
Improvement (%)			11.33%	4.20%	8.77%			1.54%	1.14%	1.70%

The normalized pillar values are obtained from equations (2a) and (2b), while the penalized pillar values are computed by solving equation (4). Results in the table refer to the case in which the organization employs 0.10 index-points to enhance its competitiveness by adopting one of the following strategies: 1) improvement of the bottleneck pillar, 2) improvement of the strongest normalized pillar (below 1), and 3) improvement of the two weakest pillars (harmonization approach).

Table 3. Regression analysis: Descriptive statistics for the selected variables

	Mean value	Std. dev.
Performance variable		
Employment growth	0.0721	0.6259
Configuration of the competitiveness system		
Core competencies (competitive strengths)	0.1344	0.3414
Harmonized	0.5056	0.5004
Bottleneck	0.3600	0.4804
Control variables		
Business size in 2010 (employees)	25.98	77.65
Business size (average employees)	26.01	75.39
Business age (years)	14.59	6.70
Manufacturing	0.3200	0.4668
Retailing	0.3968	0.4896
Professional services sectors	0.2832	0.4509
Budapest	0.1888	0.3917
Central Hungary	0.0848	0.2788
Central Transdanubia	0.0736	0.2613
Western Transdanubia	0.0704	0.2560
Southern Transdanubia	0.2960	0.4569
Northern Hungary	0.0702	0.2587
North Great Plain	0.0926	0.2904
South Great Plain	0.1216	0.3271

Number of observations: 625.

Table 4. Regression analysis: The relationship between competitiveness and employment growth

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Competitiveness index	0.0961 ***	0.0940 ***	0.0957 ***	0.0928 ***		
	(0.0191)	(0.0208)	(0.0211)	(0.0207)		
High competitiveness (above the median)					0.2189 ***	0.1077 *
					(0.0501)	(0.0648)
Competitive strengths		0.2110 **			0.2739 ***	0.1653 **
		(0.0871)			(0.0917)	(0.0843)
Harmonized			0.0416		0.1223 **	0.0420
			(0.0466)		(0.0477)	(0.0522)
Bottleneck				–0.1560 ***		
				(0.0479)		
High competitiveness X Competitive strengths						0.2094 *
						(0.1184)
High competitiveness X Harmonized						0.1643 *
						(0.0915)
Intercept	0.5494 ***	0.5310 ***	0.5304 ***	0.6208 ***	0.7092 ***	0.7516 ***
	(0.1388)	(0.1375)	(0.1458)	(0.1419)	(0.1296)	(0.1263)
F-test	9.35 ***	8.47 ***	8.76 ***	8.64 ***	7.21 ***	6.52 ***
Adjusted R2	0.1384	0.1502	0.1380	0.1508	0.1521	0.1538
Root MSE	0.5810	0.5770	0.5811	0.5768	0.5763	0.5757
Average VIF (min–max)	1.40	1.37	1.37	1.38	1.38	1.92
	(1.18–1.87)	(1.02–1.87)	(1.04–1.87)	(1.05–1.87)	(1.12–1.86)	(1.18–3.75)
Observations	625	625	625	625	625	625

Robust standard errors are presented in brackets. All model specifications include size (ln employees in 2010), business age (ln years), industry dummies (manufacturing is the reference category) and territorial dummies (Budapest is the reference category) as control variables. *, **, *** indicate significance at the 10%, 5% and 1%, respectively.

Appendix

Table A1. Description of the variables used to build the pillars that form the competitiveness index

Competitiveness pillar	Variables included in the pillar
1. Human capital	The number and share of employees with higher education degree The problems with employees The share of employees participating in training programs The sophistication of compensation systems The uniqueness of human capital
2. Product	Product innovation Activities/effort concerning the introduction of new or amended product The share of new product in sales The uniqueness of firm's product and continuous innovation
3. Domestic market	The geographic scope of selling in Hungary The level of firm's competition in the market The expected growth of the target market in five years The intensity of competition Quick response to costumers' demand
4. Networks	The number of economic cooperation and innovation agreements The time of networking as compared to the establishment of the firm The reliance to outside help in business development Uniqueness of networking relationship
5. Technology	The level of firm's technology in Hungary The age of available technology used by the firm and technological innovation Environmental investment and quality assurance The level of application of ICT tools Uniqueness of applied technology, possession of license or know-how, product management and quality assurance
6. Decision making	The application of the different sources of information The application of financial analyses in the business Information sharing Consultation in decision making Administrative routines/operations knowledge sharing of the business organization
7. Competitive strategy	The direction of strategy (defensive, proactive) Growth strategy based on the number of business units The leader's entrepreneurial traits The uniqueness of firm' proactive strategy

Table A1. Continued

Competitiveness pillar	**Variables included in the pillar**
8. Marketing	The product The pricing of the main product Sophistication of distribution channels Applied marketing and communication tools Marketing innovation The uniqueness of marketing methods
9. Internationalization	The significance of foreign buyers The share of export in sales Language capabilities at business level The uniqueness of location
10. Online presence	Webpage technical characteristics Webpage offered services Webpage content Online marketing applications

Table A2. Factor analysis: Summary of measurement results

	Variables	Cronbach's alpha	Kaiser-Meyer-Olkin (KMO) test	Eigenvalue	Variance explained (%)
Competitiveness index	10	0.8513	0.8984	4.3141	43.14
Competitiveness pillars:					
Human capital	5	0.7332	0.6146	1.5458	30.92
Product	4	0.6928	0.5899	1.6734	41.84
Domestic market	5	0.7061	0.5258	1.5784	31.57
Networks	4	0.6777	0.5945	1.8105	45.26
Technology	5	0.7297	0.6751	1.7283	34.57
Decision making	5	0.7012	0.7201	2.3121	46.24
Strategy	4	0.7114	0.5005	1.3488	33.72
Marketing	6	0.6451	0.6866	1.8823	31.37
Internationalization	4	0.7042	0.5365	2.0063	50.16
Online presence	4	0.8623	0.7901	2.9434	73.58

Number of observations: 625.