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FINANCIAL AND FINANCING CHARACTERISTICS OF HEALTHCARE SMALL AND MEDIUM-SIZED ENTERPRISES IN HUNGARY, IN A COMPARISON OF THE COUNTRIES OF THE VISEGRÁD FOUR

Theses of doctoral (PhD) dissertation

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HISTORY OF THE WORK, OBJECTIVES

My interests, my personal personal and work life experiences, and my passion for scientific work together inspired me to draw on the world of healthcare enterprises as the topic of my doctoral thesis.

In my dissertation, I aimed to present the value creation of the healthcare industry, the financial characteristics of small and medium-sized enterprises in the industry, their survival and financing characteristics in Hungary, in comparison with the Visegrád Four. In this way, I would like to draw attention to the socio-economic usefulness of healthcare SMEs, their prominent role in the national economy, and their measureless added value.

The topicality of the research is reflected in the fact that, since the Covid-19 health pandemic, special attention has been focused on the health industry and healthcare. The pandemic stimulated everyone to develop innovative healthcare solutions, so the pace of healthcare innovation accelerated to an extraordinary extent.

MATERIAL AND METHOD

In my dissertation, I put a lot of emphasis on presenting the health industry as complex as possible from the perspective of the four countries examined, through the analysis of relevant international literature and databases. To the examination of

hypotheses, I filtered the necessary data from three databases: Statista statistical database, RocketShepherd startup database and Crefoport company database.

During my empirical research, I used a number of mathematical and statistical methods to examine the health industry performance of the Visegrád countries from multiple perspectives. For the first time, I mapped the performance of this area with univariate analysis (average, sum, minimum, maximum, number of elements) before (2017-2019) and after (2020-2022) the Covid-19 health pandemic. By means of industry reports based on the Statista database, the key health industry sectors under the collective name "Health, Pharma & Medtech" (digital health industry; OTC medicines; hospitals; mental health industry; cannabis; the medical technology industry, as well as the pharmaceutical industry) were analyzed in a comparison of the V4 countries, in relation to the Covid-19 pandemic, by examining the average sales revenue of the periods. In addition, I also examined the ROA value of the health industry SMEs of the V4 countries extracted from the Crefoport database and compared my results with international research.

RESULTS

The examination of the hypotheses set up in the doctoral thesis yielded the following results in summary.

H1: During the Covid-19 pandemic, the overall performance of the health industry increased in the V4 countries.

Based on the data extracted from the database, the hypothesis was verified and accepted: based on the classification used by Statista, in the average of the 3 years before the coronavirus (2017-2019) and the years during the coronavirus (2020-2022), the total health industry sales revenue of the V4 countries increased by 17% on average, and the growth is true for the health industry performance of each of the examined countries. As a result of the crisis caused by the pandemic, the health and healthcare system came into focus, and the changes that occurred in the sub-sectors of the health industry had a positive effect on the sector's overall performance. At the same time, the rate of growth and the trend of growth differ by industry and country, presumably because of how and to what extent each country reacted to Covid-19, as well as which sub-sectors were affected favorably or adversely by the epidemic.

H2: There are differences according to company life cycles in the financing structure of companies in Visegrád countries performing traditional health industry activities and those implementing innovative health industry developments in the importance of public financing and risk capital.

There are differences in which sector of the health industry, in the public or private sector, the business or company operates,

whether it uses traditional or innovative procedures. A family doctor's practice, a medical technology supplier or a state specialist clinic has different financing requirements and opportunities than a spin-off working on an R&D-intensive new medical procedure or a startup developing an original drug molecule. An intensive increase in the ability of the health industry to attract capital can be seen in terms of dominant financing sources (Vitéz-Durgula–Pataki, 2022).

Innovative health industry developments cannot be fitted into the traditional financing structure (just as companies engaged in traditional health industry activities follow traditional forms of financing), they mostly require special financing. Based on the RocketShepherd database, it can be said about the financing of 199 Hungarian-related health industry enterprises (from the 2000s to 2021) that a quarter (57 pcs) financed their activities from their own resources (boostrapped). The other companies received funds from alternative financing sources a total of 360 times. In terms of the total value of public financing (the source comes from a community fund), it is 51%, compared to the 33% share of market-based venture capital financing. In terms of the number of public financing, it amounts to a total of 86%, of which the subsidy is 37%, and the publicly financed risk capital source is nearly 50% (JEREMIE and Hiventures sources). Market risk

capital free from state influence (based on available data) had a total value of 33%.

H3: In the V4 countries, the evolution of the probability of survival of SMEs operating in the health industry is similar, and the survival ability of these enterprises exceeds the average survival time of the entire business sector of each country.

The V4 countries can be considered each other's reference countries. Within the framework of this hypothesis, I examined what kind of similarities can be found in the viability of small and medium-sized enterprises operating in the health industry.

The Kaplan-Meier survival analyzes in the three countries examined (in the case of Poland the number of sample elements was too low and the time series was short) show similar results, the survival rate of the health industry SMEs included in the study is extremely stable. Although the survival rates in the three examined countries cannot be considered statistically the same, based on my empirical results, the Hungarian-Czech-Slovak healthcare SMEs also have a survival rate of over 90% due to economically very similar processes. The examined enterprises have a longer survival period than the average survival period of the entire enterprise sector of each country. Another common feature is that the probability of survival of the small and medium-sized business sector in the health industry in Central and Eastern European countries takes

on a similar character. The particularly high life expectancy shown by health industry enterprises operating in the countries included in the study is an important indicator that these enterprises operate stably and sustainably, are able to respond to changes in the industry and adapt to changing conditions.

This is confirmed by Baumöhl et al. (2019) as well, who, using the Kaplan-Meier survival model, examined the survival of businesses in the V4 countries between 2006 and 2015 and concluded that the healthcare industry is the second most viable industry (after education) in the V4 countries on average, with 91.5% of the examined health industry companies and businesses operated at the end of the examined period as well.

H4: The financial type phenomena of the health industry SMEs of the V4 countries show significantly similar features.

Based on my empirical investigation, following the analysis of the four financial indicators, it can be said about the performance of the health industry SME sector of the Visegrád countries that their total asset portfolio provided a profit of around 10% in the examined period, that is, they operated with an approximate rate of return of 10%. Liquidity and profitability are closely related and inversely proportional. I proved that the requirements of liquidity (solvency) and profitability apply at

the same time, so the sustainable development of enterprises at the industry level is favourable with regard to V4s, and their viability seems to be ensured in the longer term, which I verified using the Kaplan-Meier analysis during the examination of the previous hypothesis.

All in all, it can be said that the companies involved in the investigation have stable and balanced liquidity. Starting from 2008, the average liquidity takes a value of around 1.6 until 2012, then it starts to increase slightly, and from 2016 the average liquidity value exceeds 2.0, which already reflects a stable financial situation. The solvency of the middle 50% of the investigated enterprises is improving, it can be said that liquidity surplus was created. The value of indebtedness shows a favorable trend considering the aggregate capital structure of V4s. The average indebtedness of the examined SMEs is decreasing: in the source structure, the value of own capital exceeds the value of foreign capital. Even the maximum values do not reach the value of 2, when the level of indebtedness is already very high. The economic efficiency of the use of resources (efficiency) in the cases of the aggregated, analyzed V4 SMEs ranged between 1.3 and 1.4 averagely (0.7-1.1 for 2012-2013), which means that the used resources (all assets) create the return that businesses expect from their use as a whole.

H5: In the V4 countries, clusters characterized by the same type of financial phenomena can be formed among health industry SMEs, and the penetrability between these clusters is not typical in the examined period (2008-2021).

It can be said that three relatively homogenous groups with the following names and characteristics can be formed in each country based on the typical financial phenomena:

- *Cluster 1*: Leaders, the liquid legends of the health industry – Their main characteristics: maximum liquidity ratio, minimum indebtedness, maximum ROA indicator, medium efficiency.
- *Cluster 2*: Those playing for survival, the effective profit producers of the healthcare industry - Their main characteristics: medium but very high liquidity ratio, medium-high indebtedness, medium ROA indicator, maximum efficiency.
- *Cluster 3*: Those dropping behind, inefficient businessmen of the health industry - Their main characteristics: minimal liquidity value, high indebtedness, minimal ROA, minimal efficiency.

The clusters formed in this way in the individual countries can be roughly matched to the groups representing the combined Visegrád countries. Differences - as I have already mentioned a few times - are found in the examined Polish SMEs, probably

due to the smaller number of elements. Due to the greater distance between the individual clusters, penetrability is difficult, not typical.

NEW AND NOVEL SCIENTIFIC RESULTS

T1: During the period of Covid-19 pandemic, the overall performance of the health industry in terms of sales at current prices increased with varying intensity in the Visegrád countries. Significant differences can also be observed in the field of sub-sectors.

T2: A unique feature in the financing of health industry developments and startups in the V4 countries is the high proportion of public financing compared to the average low proportion of private capital. As company life cycles progress, the proportion of public financing decreases and the proportion of venture capital increases.

T3: The probability of survival of the small and medium-sized business sector in the health industry of the V4 countries is similar, but they have survival advantages through sector-specific factors, which exceed the average survival period typical of the general business sector in each of the examined countries.

T4: The financial type phenomena of the health industry SMEs of the Visegrád Four show similar features in terms of liquidity-profitability-indebtedness. All four examined countries can be considered significantly identical in terms of indebtedness efficiency.

T5: Based on the financial characteristics of the small and medium-sized enterprises in the health industry operating in the V4 countries (between 2008 and 2021), well-separated clusters can be formed. Penetrability between clusters is not significant in the examined period, indicating that the individual groups are stably separated from each other.

FURTHER SCIENTIFIC RESULTS OF THE RESEARCH

In addition to the theses, the important results of the dissertation include the following:

- provides a comprehensive summary of the literature on the characteristics of the health industry in the Visegrád countries (including the structure of the health systems and health reforms), connecting all this with the health status of the population;

- in relation to the Covid-19 pandemic, it examines the performance of the health industry by country and by industry;
- examines the health industry and the health sector from a new angle;
- provides a summary of R+D+I characteristics of the health industries of the V4 countries and the characteristics of startups in the area;
- reports on the financing of Hungarian-related health industry innovations and startups starting in the 2000s;
- Kaplan-Meier survival analysis is specifically used to examine the survival of SMEs in the healthcare industry;
- presents a complex financial analysis of V4 healthcare SMEs over a long time series;
- reveals the relationships between the financial indicators of the examined health industry SMEs and groups them.

SUMMARY - CONCLUSIONS AND RECOMMENDATIONS

Overall, I found that compared to the OECD member states, the performance of the V4 countries' healthcare system is still below the desired level, to which the strong exposure of the

population to health risks and the shortcomings of the healthcare system contributed significantly.

In my empirical research, I deduced that the aggregate health industry revenue of the V4 countries by industry increased during the Covid-19 period. I examined the performance of healthcare SMEs based on four key financial indicators from crisis to crisis (2008-2021). My results confirm that the financial type phenomena of the health industry SMEs of the Visegrád Four are similar in terms of the analyzed indicators.

Based on my primary investigation - mainly through the industry report prepared on the basis of Statista (which examines the entire corporate sector, not limited to SMEs), as well as the investigation of the RocketShepherd startup database, as well as the financial analysis prepared from the Crefoport database - I consider the prosperity of the small and medium-sized business sector of the Visegrád countries to be justified.

My analysis revealed that the profitable, efficient and stable performance of the small and medium-sized enterprises in the health industry is combined with the health status of the population of the V4 countries, which is below the OECD average. In my dissertation, I concluded that the fruitful financial results of the SME sector of the health industry in the

Visegrád countries are associated with an eroding health care system and the bad health condition of the population. This can also be considered as a specific characteristic of the health industry of the Visegrád Four.

Overall, I can say that the results and conclusions of my thesis can provide valuable information to government/policy makers to support healthcare businesses and improve healthcare systems. In addition, it gives the representatives of life sciences ecosystem, the managers of businesses, companies, and investors a deeper insight into the financial performance of the health industry SME sector in the Visegrád countries, thus setting the direction for what steps they can take in the future to promote the further development of small and medium-sized enterprises in the health industry.

The added value of my results is that the internal dynamics, correlations and trends within the health industry can be better understood. My research enriches the literature on corporate financing, health economics, business development, small and medium-sized enterprises, and financial performance.

The research can be continued in many directions, even by breaking down the limits of my doctoral dissertation. Limitations of the primary study include the fact that Statista uses a specific industry classification (which does not include the red biotechnology industry). The RocketShepherd startup

database focuses on Hungarian data, more limited on the V4 countries. Comparing the data of other well-known international startup databases (Dealroom, Crunchbase, Pitchbook) would greatly increase the representativeness. Due to the characteristics of the Crefoport database, compared to the Czech, Slovak, and Hungarian data sets, the number of Polish enterprises included in the study is smaller and covers a shorter time series.

The analysis could be extended to the entire Central and Eastern European region, the entire corporate sector, or it could be expanded to include additional financial indicators.

In addition, the research can be narrowed down to: examining the financial performance of the SME sector of the health industry, due to the aggregated data covering the sector as a whole, the changes and trends that occurred in certain industries of the health industry in the given years cannot be identified, a more detailed analysis of these can form the basis for further research.

Supplementing the survival analysis with a bankruptcy forecast would lead to valuable results. This would create an opportunity for enterprises, investors, and state actors to have more reliable risk management and to prepare for crises.

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