Differences between Hungarian Innovation-Driven and Innovative Enterprises Based on Primary Research*

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The extensive growth model of the Hungarian economy in the 2010s should be gradually completed and then replaced by an intensive growth framework with innovation at its core. This is why it is important to gain a deeper insight into the innovation process. Innovation-driven enterprises are a specific group of innovating firms, which are special in that they achieved rapid revenue growth in their innovation-oriented business in the 2010–2019 business cycle. In our research, we explore what factors influence rapid growth among innovative firms. Our results indicate that the factors supporting growth were rising technological and human capital levels, increasing export intensity and improving access to venture capital, while the credit financing at low interest rate that characterised the previous decade did not lead to rapid growth in the distinctive innovation-driven segment. Innovative enterprises are typically robust companies with strong indicators and in many cases (entrepreneurial capacities, attitudes or perception of the market) they show similarities to enterprises in the innovation-driven group.

Journal of Economic Literature (JEL) codes: C83, O39, O49

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1. Introduction

The catching-up of the Hungarian economy in the 2010s was based on growth that was mainly driven by extensive (quantitative) factors. However, the demographic trends, economic structure conditions and developments in commodity markets

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underscore the imperative to transition towards a new, intensive growth paradigm in order for growth to continue. This paradigm is based on boosting productivity and competitiveness, and optimising energy efficiency as essential components. In 2023, Hungary was ranked third out of four clusters as assessed in the European Innovation Scoreboard based on the Oslo Manual (*OECD/Eurostat 2018*), classified into the group of "moderate innovators". One fundamental element of this intensive growth transformation is to foster an innovative corporate sector characterised by continuous renewal, ensuring the expansion of value-creating capacity in the Hungarian business landscape through the generation of marketable knowledge and skills.

In this study, we investigate the often elusive factors that contribute to the rapid growth of innovative businesses. This research contributes to the domestic innovation literature by examining two distinct groups of economically robust firms with observable innovation capabilities. These groups consist of enterprises that (a) received an R&D innovation tax allowance or were listed in the patent and trademark database of the National Intellectual Property Office; or (b) applied for innovation development grants from the National Research, Development and Innovation Office (NRDIO). Growth drivers are identified through an examination of individual, primary research data from innovative firms.

In *Section 2 of* the paper, we review the relevant literature. In *Section 3* we present the data utilised for our analysis, while *Section 4* outlines the methodology. Our findings are then presented in *Sections 5* and *6*, with *Section 7* summarising our conclusions.

2. Literature background and motivation

While innovation is a crucial factor, it alone does not guarantee successful convergence in economic development. Achieving sustained, rapid economic growth is not solely contingent on innovation; it also requires entrepreneurial skills. There is a prevailing perception that fast-growing firms, often referred to as gazelles, outperform incumbent firms in terms of competitiveness. Empirical evidence, however, challenges this assumption (*Szerb et al. 2017*). Contrary to the expectations, (non-innovative) gazelle firms achieve rapid growth as one-hit wonders, lacking sustained innovation or external market ambitions. Consequently, they struggle to replicate their initial outperformance (e.g. *Parker et al. 2010*; *Hölzl 2014*; *Daunfeldt and Halvarsson 2015*; or, in the Hungarian context, *Szerb et al. 2017*; and *Komlósi and Szerb 2016*). Various business demographic features (such as industry, firm size, age and geographic location) play a role in determining whether a firm qualifies as a growth gazelle. Surprisingly, less than one fifth of these

firms exhibit innovative behaviour based on historical performance data (*Szerb et al. 2017*). Recent research by *Varga-Csajkás et al.* (*2019, 2023*) investigates the relationships between physical proximity and innovation collaborations among Hungarian high-tech gazelles using an agent-based model. Beyond geographical distance, alternative dimensions of distance – specifically technological and social distance – have a significant impact on the formation and density of innovation collaborations. *Bodor et al.* (*2019*) extend this inquiry by examining social capital in non-innovative Hungarian gazelles. Their findings reveal that all three types of social capital (connecting, linking, bonding) are only marginally accessible to these firms. Notably, the fastest growing companies with superior innovation performance exhibit distinct financing profiles: one group relies on bank and grant funding (linking social capital), while the other segment of gazelles secures financing through relatives and friends (bonding social capital).

The prevailing belief is that innovation significantly enhances the productivity of companies, thereby contributing to overall economic growth. In the context of Hungary, *Halpern* (*2020*) conducted empirical research and identified two distinct channels through which innovation influences productivity. Firstly, innovation directly improves productivity levels. Secondly, it indirectly impacts productivity by influencing the prevalence of innovative firms within the economy. The direct effect is nuanced by the fact that higher innovation performance as a share of assets is associated with higher profitability only above a certain level (*Nádudvari 2017*). *Dai et al.* (*2019*) investigated the aggregate impact of firm-level innovation on overall productivity growth. They found that the small impact of company innovation on aggregate productivity growth is primarily attributable to suboptimal resource allocation within innovative enterprises. This suggests that the relationship between productivity growth and innovation is not unambiguously positive, and the direction of causality is not clear (*Halpern 2020*; *Kiss 2022*). Statistically, innovative firms tend to exhibit higher productivity levels compared to non-innovative firms. Conversely, more productive enterprises are also more inclined to engage in innovative activities. These patterns are similar in the literature concerning the interplay between innovation and foreign market activity (*Melitz 2003*; *De Loecker 2007*). Beyond productivity gains, innovative companies can reach broader markets by enhancing the attractiveness of their products. This phenomenon which underscores the relationship between innovation and foreign market presence in the domestic context was studied by *Halpern and Muraközy* (*2010*).

High, sustained growth in innovative companies is not guaranteed, as previously discussed. Innovative performance is influenced by a range of external and internal factors, including cooperation, customer and supplier relationships, organisational flexibility, education system, tax policies, support mechanisms and financing options,

as well as managerial attitudes and behaviour (*Kiss 2001*; *Pál 2007*; *Kiss 2013*; *Borsi 2017*; *Gelei and Kenesei 2017*; *Katona 2021*; *Ónodi and Répáczky 2022*). Some of these characteristics can also contribute to entrepreneurial success. Geographical distance plays a significant role in determining the extent of innovation and the formation of collaborations (*Grosz 2011*). However, it is not the sole factor. Beyond geographical distance, scientific studies increasingly focus on the impact of other distance-related aspects on fostering innovation (*Bodor et al. 2019*; *Varga-Csajkás et al. 2019, 2023*). Firms with well-developed innovation cultures exhibit higher rates of competitiveness and success (*Saxenian 1996*). Innovation culture encompasses factors such as encouraging new ideas, creativity and risk-taking. Notably, Hungarian innovative firms and entrepreneurs demonstrate stronger risk-taking behaviour compared to the national average: They accept the risk of making mistakes and perceive such as learning experiences (*MNB 2023*).

3. Data

The Magyar Nemzeti Bank (MNB, the central bank of Hungary) identified 1,134 gazelle-growth and innovative Hungarian Innovation-Driven Enterprises (HIDE) in its Growth Report 2023 (*MNB 2023*). In the realm of IDE research, data availability confers a distinct advantage in areas such as venture capital finance, while in other domains, the lack of representative data sources on innovation-driven firms remains the primary impediment to empirical results (*Botelho et al. 2021*). Despite the scholarly efforts, well-defined, general characteristics of IDEs have not been identified by the experts in the field. In contrast to the narrow perspective presented in *Aulet and Murray* (*2013*), we adopt a more inclusive approach. Hungarian IDEs are not solely confined to firms with explicit innovation outcomes (patents, trademarks, R&D expenditure tax credits or government aid for firm development) that also exhibit rapid growth (so-called "gazelle" status). Instead, we incorporate companies that demonstrated gazelle-like growth between 2010 and 2019, even if their innovation activity was then only observed in the subsequent period. These firms likely achieved competitiveness in external markets due to innovation, prompting their inclusion. Our definition considers a company to be an exporter if at least 10 per cent of its turnover originates from export sales.[1] We also account for a phenomenon observed in Hungary, where companies often register patents for innovations that improved competitiveness after experiencing rapid growth. These firms have transitioned to the later phase of the life cycle of innovation-driven companies, where their external market activity's competitiveness is ensured by the innovation they apply, sometimes registered later for strategic reasons.

[1] In using this boundary, we followed the practice of the World Bank Enterprise Survey (*World Bank 2023*).

In 2010, despite constituting a mere 0.3 per cent of all partnerships, innovation-driven firms accounted for 13 per cent of gross exports and more than 22 per cent of average GDP growth (*MNB 2023*). The presence of innovation-driven enterprises offers Hungary a promising avenue for sustaining and accelerating economic growth, thereby facilitating the convergence process.

3.1. The business population on which the survey is based

The questionnaire survey employed in this study was conducted within the framework of a Hungarian multi-stakeholder project. The project's primary objective is to achieve a more comprehensive and deeper understanding of the innovation and economic readiness of domestic enterprises (see *MNB 2023*). Collaboratively initiated by the Hungarian government, academia, financiers, companies and business entrepreneurs, this endeavour commenced in 2022 with the ultimate aim of formulating a regional enterprise development strategy based on innovation support. Given that certain aspects of the innovation process and both innovation capacity (I-CAP) and entrepreneurship capacity (E-CAP) remain invisible in direct statistical measurement, the secondary research was accompanied by a concurrent primary survey. These data constitute the foundational basis for our subsequent analysis.

The data analysed in this study consists of responses from a primary questionnaire survey designed to delineate the characteristics of Hungarian innovative and innovation-driven enterprises. These characteristics are often unidentifiable from existing statistical databases. The survey was conducted as a part of the NRDIO data collection procedure during the period of September to November 2022. The questionnaire was sent to 500 enterprises meeting specific criteria. These criteria included enterprises that had received an R&D innovation tax allowance, were listed in the National Intellectual Property Office's database of patent and trademark data, or had applied for innovation development support from the NRDIO. Survey participants completed the questionnaire anonymously, precluding the identification and linkage of their business demographics and economic performance to individual companies. From the 200 questionnaires received, we filtered out incomplete responses and duplicates. Some enterprises may have initiated the questionnaire multiple times, leading to several incomplete responses before the final, comprehensive submission. Additionally, instances were observed where multiple individuals within a single company completed the online questionnaire. In such cases, we considered the last fully completed response. Following rigorous data cleaning procedures, the database comprised 182 complete records. Among the respondents, 72 innovation-driven and 110 innovative enterprises were represented.

3.2. Characteristics of the questionnaire

In addition to inquiries regarding the respondent's gender and highest level of education, the questionnaire encompassed a comprehensive set of 40 questions, organised into five distinct thematic areas:

(1) the innovation-economic environment,

(2) human capital,

(3) financing,

(4) market competition, and

(5) the role of cultural and motivational factors in innovation.

In the context of the *innovation-economic environment*, the questionnaire inquired about the companies' intellectual property rights, the regularity of R&D, the development of production and development processes, export activity and the extent to which they consider continuous innovation essential for business growth. The section on *human capital* delved into the qualifications and educational backgrounds of the employees and available workers. Specifically, it examined the presence of engineering expertise and PhD qualifications among personnel, as well as their active involvement in research and development endeavours. Regarding *financing*, the survey comprehensively covered the (perceived) availability of various financial sources such as bootstrapping, loans, government subsidies, venture capital and business angels. *Market competition* was another critical dimension explored. The survey assessed the market size, the strength of industry competition and the market and public-sector demand. Lastly, the questions on *cultural and motivational factors* included the reasons for business initiation (e.g. family considerations, financial aspirations, independence and career change) and entrepreneurial attitudes (risk-taking tendencies and tolerance for failure).

The survey questions systematically explored qualitative, firm-specific pieces of information, needs and satisfaction levels that cannot be obtained from administrative data sources. These inquiries provide insight into both entrepreneurship capacity (E-CAP) and innovation capacity (I-CAP) within organisations (*Budden et al. 2017*). Notably, the timeliness of responses enhances their value. The questionnaire deliberately omits inquiries related to physical and digital infrastructure, as Hungary, in international comparisons, boasts a favourable position in this regard (see *Szerb et al. 2020*; *MNB 2022*). While infrastructure significantly influences firms' innovation and entrepreneurial capacity, sporadic degradation within the dynamic business environment may have a slight impact.

The questionnaire featured two distinctive types of questions. In 39 cases, participants were asked to express their views by selecting a value on a 6-point Likert scale (see *Dusek 2024*), where a value of 1 denoted total disagreement and a value of 6 indicated total agreement. In all cases, respondents had the option to select the answer "I don't know / I have no information". The latter answer was deliberately added when compiling the questionnaire in order to capture respondents' attitudes towards a statement in finer detail. The remaining question inquired about the availability of 13 specific types of funding. For each funding category, respondents could choose from three options: available („Yes"), not available („No") or not known ("I don't know"). All 182 respondents could choose from three options. Interestingly, certain variables elicited a higher frequency of "I don't know / I have no information" responses, while the companies that completed the questionnaire exclusively or almost exclusively gave Likert scale answers for other questions (*MNB 2023:59*). This observed pattern informed the subsequent empirical analysis, as detailed in Section 5 (Estimation results).

Table 1
Descriptive statistics for variables in the primary database

	Number of questions	Minimum number of respondents		Average number of respondents		Maximum number of respondents	
		IDE	I	**IDE**	**I**	IDE	I
Innovation	7	69	108	**71.6**	**109.0**	72	110
Human capital	8	63	90	**69.4**	**104.4**	72	109
Financing	4	61	94	**65.0**	**101.3**	70	109
Market	5	65	103	**70.4**	**107.6**	72	110
Motivation	15	61	83	**64.7**	**99.0**	71	108
Total	*39*	*61*	*83*	***67.7***	***103.2***	*72*	*110*
Financial instruments	13	45	64	**56.6**	**86.2**	70	105

Source: MIT – IDE project questionnaire survey

4. Applied methodology

To identify the essential characteristics that distinguish innovation-driven companies from innovative ones and to estimate their partial effects, a linear probability model (LPM) and probit regressions are used.[2] The response variable of the models is innovation-drivenness, and the independent variables are selected from the survey questions. The inclusion of the latter (Likert-type) variables in regression models is a task that requires caution, for which several approaches can be found in the practical literature (*Dusek 2024*).

[2] The applicability and differences are explained in detail by *Maddala* (*1983*).

4.1. Transformation of variables

One common practice is to include an explanatory variable as a categorical one, which is equivalent to taking *m* different levels of a variable and creating binary responses from them and including *m–1* dummy variables in a regression equation, to avoid perfect collinearity. The disadvantage of this approach is the significant reduction in the number of cases per variable that results from the creation of many new variables. This can lead to a loss of statistical power.[3] In our case, the small sample size (n = 182) allows for a maximum of 6–9 explanatory variables to be included in the regression models. Therefore, the application of dummy coding in the above manner would exhaust our possibilities with response options to a single question.

The literature often treats Likert items as interval or ratio variables.[4] Beyond raising questions regarding the applicability of parametric statistical methods, this approach has the disadvantage of excluding the possibility that steps on the scale values may have different effects. Furthermore, in our case, this is not a viable option because the responses "I don't know / I have no information" beyond the scale have a particular explanatory power for a statement,[5] which we intend to consider in the models.

The solution we employ is dichotomisation, a common practice for Likert scales with an even number of response options and for continuous variables as well (e.g. *MacCallum et al. 2002*). However, it also influences statistical power and the proportion of explained variance (*Cohen 1983*). This approach treats responses indicating agreement and disagreement as a single, unstressed unit. Although this results in a loss of information, the direction of the answers remains unchanged. In addition, the „I don't know" option, which indicates a lack of information, can be used as a separate category (this particular form of dummy coding may be referred to as „trichotomisation" or „pairwise dichotomisation"). If none of the respondents selected the „I don't know" option for a given statement, it was included in the equation as a binary variable. In instances where a categorical variable has three levels (No information – Agree – Disagree), they are incorporated into the regression equations as two binary variables.

[3] For logistic regression, simulation studies suggest a minimum of 10 observations per variable (*Peduzzi et al. 1996*).
[4] On the various approaches to the statistical treatment of Likert and other types of scales, see for example *Harpe* (*2015*).
[5] This relevant specificity among claims about financial instruments was shown in a previous analysis (*MNB 2023:59. Figure 5-19*).

4.2. Linear probability model

In light of the aforementioned considerations, the following linear probability model was estimated:

$$Y_i = \beta_0 + \beta_1 D_{1i} + \beta_2 D_{2i} \ldots + \beta_k D_{ki} + u_i, \quad (1)$$

where Y_i = 1 indicates that company *i* is fast growing and Y_i = 0 indicates that company *i* is innovative. $D_i = (D_{1i}, \ldots, D_{ki})$ denotes the vector of dummy variables, β_0 is the constant, β_1, …, β_k is the vector of coefficients and u_i is the error term. Based on the linear probability model, $P(Y = \text{fast growing} | D) = E(Y = \textit{fast growing} | D)$ equation (1) says that the probability that a firm is innovative and fast-growing is a linear function of the explanatory variables. Furthermore, the estimated coefficients measure the predicted change in the probability that a company is IDE when an explanatory variable increases by one unit, holding the others constant. For this reason, the choice of the base values of the variables is important from an interpretative – and in some cases econometric – point of view. Following from this, the category „Disagree" was set as the baseline in all cases.

Table 2
Managerial opinions marked by the explanatory variables

Variable name	Statement in the survey
Access to financial support	My business has easy access to R&D public financing.
Market size	The market size is appropriate, and the customer base of my business is well known and segmented.
Access to credit	My business can easily get credit.
Technological level	We are satisfied with the technological infrastructure needed to run the business.
Export share	The majority of our sales come from export markets.
Qualified labour force	Our employees are well qualified.
Access to venture capital	If my business needed to, I could easily contact business angels/venture capitalists.

Source: MIT – IDE project questionnaire survey

Based on economic theory and statistical reasons, 7 questions were selected for the estimation *(Table 2*). From a statistical perspective, the explanatory power and the information criteria of the models were considered. Following the division of the variables into two or three categories, we included a total of 12 explanatory variables in the initial model.[6]

4.3. Probit model

One drawback of the linear probability models is that the estimated probabilities are not guaranteed to fall within the interval [0;1] (e.g. *Wooldridge 2008*). A solution to this issue is to transform the probabilities with distribution functions, as these are monotone and taking on values from the interval [0;1].

Using the standard normal distribution, we obtain the probit model:

$$P(Y_i = 1|D) = \Phi(\beta' D) = \int_{-\infty}^{\beta' D} \varphi(z)dz\,, \tag{2}$$

where $\Phi(z)$ is the cumulative distribution function of the standard normal distribution, $\varphi(z)$ is the density function, and $\beta' D = \beta_0 + \beta_1 D_{1i} + \beta_2 D_{2i} \ldots + \beta_k D_{ki}$. For the initial probit specification, the independent variables listed in *Table 2* were used, the same as those included in the linear probability model described by equation (1). The coefficients of the probit model are difficult to interpret in their original form. Therefore, we present the marginal effects in the study instead.

5. Estimation results

The estimation results of the above-described model specifications are presented in *Table 3*. In a probability context, the outputs fall between 0 and 1, but the coefficients shown later can be interpreted as percentages (semi-elasticities) after multiplication by 100. The probability of an event occurring with certainty is then 100 per cent. For the interpretation of the coefficients, we follow the latter.

[6] In the two cases where there was only *1* "I don't know" response to a question included in the model, the observations were deleted and only 1 dummy variable was included. These cases do not affect the estimated coefficients, as the observations devoid of an error term. Furthermore, calculating an F-statistic to assess the group significance of the variables would be infeasible for the full set of explanatory variables.

Table 3
Regression results

Dependent variable		P(grew rapidly=1)		
		Linear probability model	**Probit regression I.**	**Probit regression II.**
Access to financial support	Do not know	**0.69*** **		
		(5.97)		
	Agree	0	–0.01	
		(–0.02)	(–0.07)	
Market size	Do not know	**–0.60*** **		
		(–4.14)		
	Agree	–0.02	–0.05	
		(–0.25)	(–0.50)	
Access to credit	Do not know	–0.17	**–0.21***	–0.18
		(–1.36)	(–1.84)	(–1.56)
	Agree	**–0.26*** **	**–0.28*** **	**–0.26*** **
		(–3.39)	(–3.82)	(–3.60)
Technological level	Agree	**0.21****	**0.23*** **	**0.18****
		(2.48)	(2.95)	(2.26)
Export share	Do not know	**–0.34*** **		
		(–4.56)		
	Agree	**0.20****	**0.20*** **	**0.17****
		(2.57)	(2.64)	(2.31)
Qualified labour force	Agree	**0.21*** **	**0.22*** **	**0.26*** **
		(2.8)	(3.1)	(3.63)
Access to venture capital	Do not know	0.1	0.13	0.14
		(0.92)	(1.21)	(1.3)
	Agree	0.11	**0.14***	**0.14***
		(1.32)	(1.77)	(1.76)
N		179	173	177
R-squared/Pseudo R-squared		0.148	0.164	0.147

Note: „Do not know" and „Agree" denote binary variables, where the baseline is „Do not agree".
The t-statistics are in brackets.
*Significance levels are indicated by *** (p<0.01), ** (p<0.05), * (p<0.1).*
The probit regression coefficients indicate marginal effects.
Goodness-of-fit metric for the probit models is pseudo R-squared.

Source: MIT – IDE project questionnaire survey

In each case, disagreement with the statement was chosen as the state 0 of the category variables – the state to which we relate the coefficient associated with each category level. That is, for example, for the last specification, „an innovative firm that agrees with the statement that most of its revenue comes from export sales is 17 per cent more likely to grow rapidly than an innovative firm that disagrees with the statement". Of course, the statistical conclusions can be formulated in a less fragmented way, such as „innovative firms that mainly export are 17 per cent more likely to grow faster than their less exporting or non-exporting counterparts". For the interpretation of the coefficients, we follow this latter, more simple approach.

5.1. Model specifications and coefficients

The probability of high growth of innovative firms is explained by the explanatory variables at almost 14.8 per cent ($R^2 = 0.148$) in the linear probability model (*column 1 in Table 3*). The binary cases of the variables *access to financial support*, *market size* and *export share* when respondents answered „I don't know" to the statement are significant only in this model specification, and at a significance level of 1 per cent. The probability of rapid growth is significantly higher ($\beta = 0.69$) for firms that lack information on their ability to access government subsidies than for those that do not have access to government aids. Conversely, the probability of rapid growth is diminished when an innovative company does not know its own demand (*market size*: $\beta = -0.60$) or is uncertain whether a larger share of its turnover comes from exports (*export share*: $\beta = -0.34$), in comparison to companies that disagree with the relevant statements.

We incorporated all modellable[7] variables into the initial probit regression (*column 2 of Table 3*) that were also included in the linear probability model. In this specification, the coefficients of easy access to government aids (*access to financial support*) and knowledge of a well-defined market size (*market size*) are also not significant. Therefore, these insignificant variables were left out from the final model equation. Consequently, the second probit specification (*column 3 of Table 3*) contains 7 explanatory variables, which fulfils the criterion of a minimum of 15–20 observations per covariate (see *Hair et al. 2018*) and thus provides sufficient statistical power.

5.2. The final model equation

In the second probit equation, the value of the pseudo-R^2 shows that about 14.7 per cent of the variability of the response variable can be explained by the independent variables. The dependent variable takes a value of 1 if the innovative company

[7] The probit specifications indicated perfect prediction due to single observations in given categories of these variables. Therefore, in these specifications the perfectly predictable observations are omitted from the fit (e.g. *Kunz et al. 2017*). Thus, the sample element number of the first probit model changes to 173, while the number of cases in the second model changes to 177.

demonstrated rapid growth in the 2010s and 0 if the innovative company did not exhibit gazelle-like growth. The results of our primary research indicated the presence of 7 such variables or 5 characteristics. Consequently, the number of independent variables compared to the sample size does not reduce the power of the estimation (α).

Companies that are satisfied with the quality of their technological infrastructure are more likely (18 per cent) to have grown rapidly in the 2010s. This is consistent with the observation that technological advantage can also be regarded as a competitive advantage, which can be used to gain market power and increases sales. The quality of the workforce also shows a significant positive relationship with growth prospects. Innovative companies that employ well-qualified workers are 26 per cent more likely to grow at a rapid, gazelle-like pace.

The coefficient of export market orientation (*export share*) is statistically significant, indicating that a focus on foreign markets is associated with a significant, 17 per cent increase in the probability of innovation-driven status. In other words, companies that derived a larger share of their turnover from exports are more likely to experience rapid growth than innovative companies which focus more on the domestic market.

Easy access to credit reduces the probability of rapid growth by 26 per cent on average. The contradiction between attracting funding and growth probability is apparent. Almost half of innovation-driven companies were supported by the Funding for Growth Scheme of the Magyar Nemzeti Bank, but the programme helped small and medium-sized enterprises to access credit (*Hegedűs and Schmidt 2022*) in times of credit constraints (*Bodnár et al. 2014*). The years after 2017 were characterised by a period of funding at low interest rates, during which time companies had an abundance of funds to invest, but under tight labour market conditions. In the oral interviews and discussions that followed the questionnaire, innovation-driven enterprises highlighted that they had acquired production lines during the favourable interest rate environment of the 2010s. These were not needed for production at that time and their utilisation rates have remained very low since then. In other words, while the inexpensive funds were utilised by rapidly expanding domestic innovative firms, the resulting additional investments did not increase their net sales.[8] On the other hand, in numerous instances, start-ups with considerable growth potential are unable to access bank loans due to the insufficient number of or stable completed business years.

[8] The companies surveyed completed the questionnaire in autumn 2022. This may lead to a temporal inconsistency in the interpretation of the results, as while the rapid growth of companies was achieved in the 2010s, the survey was conducted in the year following two crisis years (2020 and 2021).

Finally, the results indicate that venture capital financing has a growth-enhancing effect. Companies that (potentially) easily reach venture capitalists are more likely to experience accelerated growth than those that do not think they have easy access to venture capital. This result is in line with the theoretical expectations. This is because companies that access venture capital funding are not eligible for bank loans as start-ups. However, raising funds at the *seed* stage is crucial to their growth potential (*MNB 2023*).

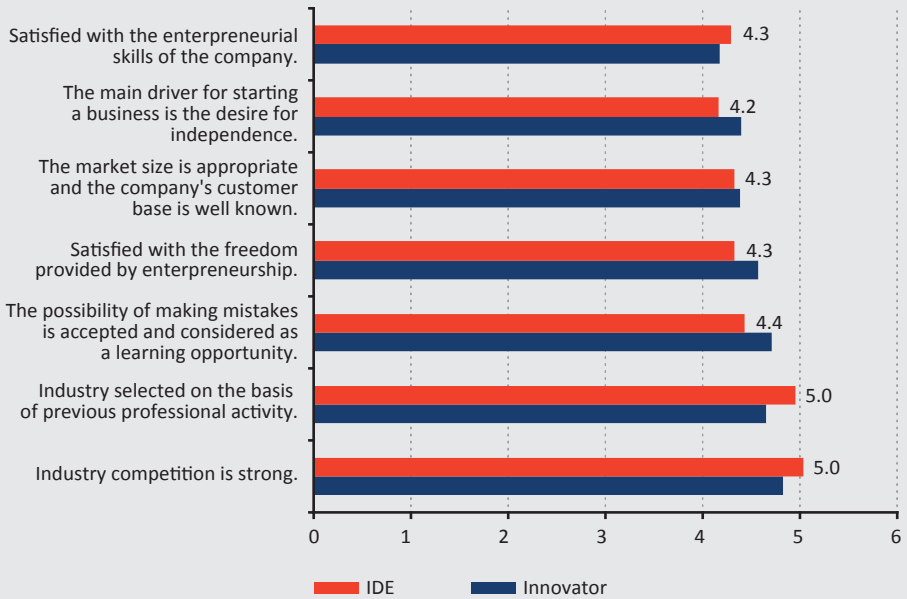
6. Other results

As previously stated, the control group was comprised of innovative (but not fast-growing) enterprises, a segment which is also characterised by robust performance indicators. Consequently, no significant partial effects were found in factors that would otherwise be expected in the case of a general control group of companies. These results are discussed in the following sections.

6.1. The role of the competitive environment and motivations

In many cases, innovative and innovation-driven companies provided similar responses. *Figure 1* illustrates the operational characteristics of firms for which the average of responses was 4 or higher on the Likert scale. For these variables, innovative and innovation-driven enterprises gave a similarly high number of agreeing responses. They regularly spend on corporate R&D and believe that continuous innovation is a prerequisite for market expansion. In addition, entrepreneurial skills and attitudes are uniformly dominant among the respondent companies. Both groups perceive intense and competitive environments, which may be related to their specific sectoral clustering. 43 per cent of innovation-driven firms operate in knowledge-intensive, highly specialised, narrow industries such as natural science and technical research and development, computer programming, engineering, technical/business management, information technology advisory services and other niche markets (*MNB 2023*). Maintaining a competitive position is a strong motivation for both innovative and innovation-driven companies. Although companies consider competition in their market to be strong, the size of the market itself was found to be appropriate. These companies were set up with the intention of becoming independent, utilising the experience gained from previous activities.

Figure 1
Characteristics of corporate operation in innovative and innovation-driven enterprises



Note: Answers with an average score of at least 4 based on the Likert scale evaluation. The averages of IDEs are highlighted.

Source: MIT – IDE project questionnaire survey

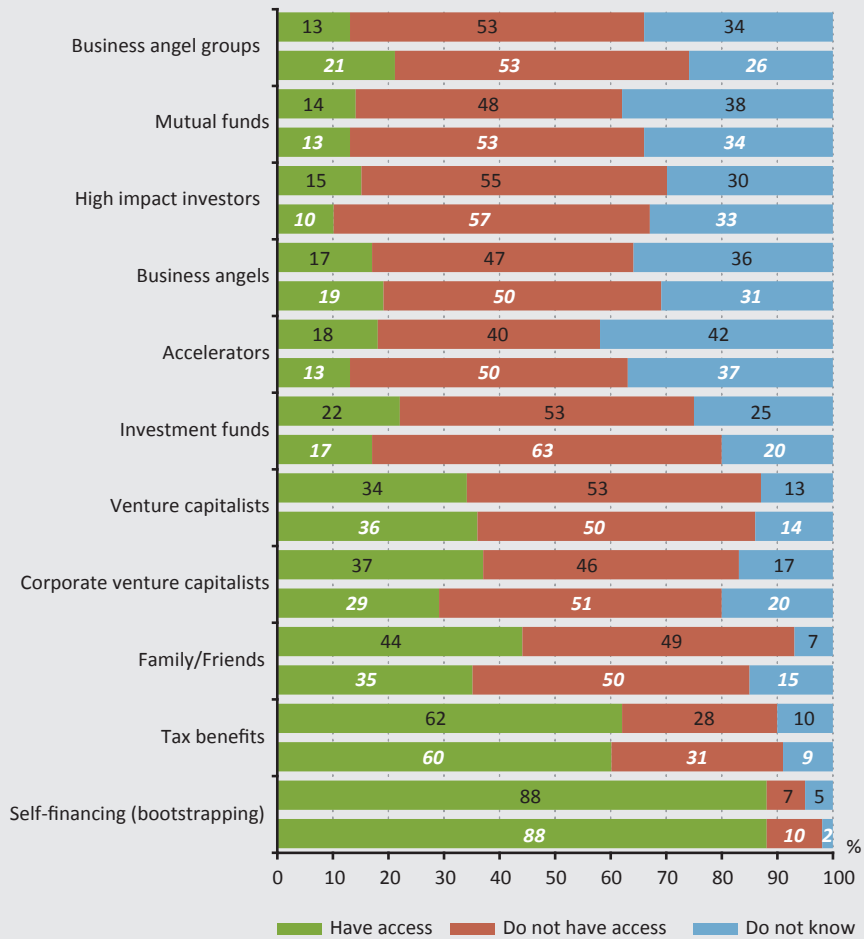
Both innovative and innovation-driven companies believe that the risk of failure is accepted. Mistakes made within companies are regarded as an inherent and inevitable aspect of the learning and development process. This perspective is not commonly held among those who aspire to establish a new business in Hungary. The willingness to become an entrepreneur in Hungary is strongly influenced by the fact that among those who see a good opportunity in starting a business only 16.8 per cent of Hungarian adults (nearly one in six respondents) are not afraid of the potential failure of becoming an entrepreneur, which is very low by international standards (*GEM 2021*).

6.2. The role of funding

Among the various forms of financing, self-financing (88 per cent) and tax allowances (62 per cent and 60 per cent, respectively) are the most accessible fundraising options for the majority of firms (*Figure 2*). Bootstrapping, a form of self-financing, entails the reinvestment of initial revenue by newly created businesses in their own development, thereby enabling them to grow from their own resources. 160 companies indicated that they applied this form of internal business financing, which can also be used for new core innovations. Revenue growth is related to the

equity ratio (*MNB 2023*). In addition, it is an opportunity for businesses interested in innovation to grow faster than they could on their own by leveraging external partners (raising funds).

Figure 2
Distributions of responses to forms of financing among innovation-driven and innovative companies



Note: For each form of financing, the upper bands and distributions refer to innovative enterprises, while the lower bands below them and the values in white, bold, italics refer to IDE enterprises.

Source: MIT – IDE project questionnaire survey

In relation to funding opportunities, it is important to note that in some cases a significant proportion of respondents selected the „I don't know" category. This indicates that certain forms of financing were not considered viable alternatives or were not known to companies. More than 30 per cent of respondent companies

were uncertain as to whether they could readily establish contact with accelerators (42 per cent and 37 per cent, respectively), business angels (26 per cent to 36 per cent) or mutual funds (38 per cent and 34 per cent). Alternative corporate financing options are therefore difficult to access for innovator companies, which is compounded by the fact that these options are not widely known among companies (*MNB 2023*).

7. Conclusions

In this research, we endeavoured to address the inquiry of the factors distinguishing innovation-driven enterprises from solely innovative ones. In 2023, based on the essay by *Aulet and Murray* (*2013*) and their own conceptualisation, more than 1,100 innovation-driven enterprises were identified in Hungary (*MNB 2023*). We define innovation-driven enterprises as those that have achieved rapid sales growth in their innovation-focused business during the 2010–2019 business cycle, specifically maintaining an average sales growth of at least 20 per cent over three consecutive years. Build upon these findings, our research question focuses on identifying the often elusive factors that contribute to accelerated growth among innovator firms beyond the mere presence of innovation. Existing literature has demonstrated that innovation alone does not invariably translate into business success. Furthermore, innovation inherently carries the risk of failure. Nevertheless, regardless of the growth indicators, these enterprises willingly embrace the inherent uncertainty and endeavour to learn from the outcomes of ideas that do not yield the desired results.

This study examines a cohort of over 1,100 innovation-driven enterprises, identified from administrative data sources (*MNB 2023*). The secondary research was complemented by primary research. Specifically, we analyse data from this anonymous primary survey. Our findings revealed that innovative enterprises exhibit robust characteristics, as evidenced by hard indicators. Furthermore, in numerous instances, these enterprises share similarities with firms categorised as part of the innovation-driven group, particularly in terms of entrepreneurial capacities, attitudes, and market perception.

The rapid growth in this specific segment is influenced by distinct factors. Our findings indicate that the growth drivers encompass increased technological and human capital levels, export intensity and access to venture capital. Notably, traditional credit at low interest rates, which was prevalent during the pre-COVID economic cycle, has not significantly contributed to rapid growth within this priority group. Surprisingly, even for innovator companies characterised by advanced technological performance, the expansion of cutting-edge technological capabilities correlates with accelerated growth prospects. The nuance is underscored by respondents' satisfaction with their own production technology, which distinctly

impacts growth. A similar argument applies to highly qualified (skilled) labour. At the end of the 2010s, there was a substantial increase in demand for live workforce, particularly among experienced professionals. Nevertheless, the perception of employee skill levels, as perceived by respondent firms, significantly influences our estimation equation. Intense foreign market activity emerges as a clear growth driver in this business segment. Notably, venture capital financing, due to its sporadic distribution, only exhibits significance at the 10 per cent level. The role of finance including private equity financing, assumes critical importance, as emphasised in our study and in the final Section of the Growth Report 2023, particularly for risky start-ups investing in innovation.

The analysis was based on the responses to a cross-sectional questionnaire conducted in autumn 2022. The survey targeted a group of enterprises with a general propensity for innovation, but only a subset of these enterprises (innovation-driven enterprises) exhibited rapid growth in the 2010s. Despite potential temporal discrepancies, we discerned factors that defy straightforward quantification within a model-based framework, elucidating the disparities between the two groups. The retrospective nature of our analysis raises the possibility that the determinants of rapid growth during the interceding period between global economic crises may have also influenced adjustment in the 2020s. It is essential to stress again that certain criteria remain time-independent (e.g. human capital, export orientation or financing situation), and the resilience of innovator firms during crises mitigates distortions. However, the interpretive framework relies on one-time, non-disclosable cross-sectional data, limiting our research due to the timing of business opinion surveys and inherent anonymity of the questionnaire. Consequently, we were unable to establish the link between the business ratings and demographic characteristics (e.g. sector, size and age of companies, and geographical location) or economic performance.

Research concerning the nexus between innovation and growth remains a dynamic and intellectually challenging domain. It is incontrovertible within professional circles that innovation, as a catalyst of economic growth, assumes a pivotal role in shaping economies and societies. Given the evolving landscape of technology and economic paradigms, there is a growing demand for rigorous, contextually pertinent research in this specific field. To foster professional discourse and deliberation, it is imperative to delve further into this intricate relationship. Such exploration necessitates a comprehensive examination that combines observable business demographics with latent firm attributes. By unravelling the multifaceted interplay between innovation and economic growth, we can adopt a pragmatic perspective on the mechanisms driving economic development. Moreover, this enhanced understanding will inform the design of more effective policies aimed at promoting innovation conducive to societal well-being and sustained economic progress.

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