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Determinants of Fintech Fundraising in Europe

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Abstract

The study examines how the sub-indices of the Global Innovation Index (GII) affect the total value of fintech (financial technology) start-up fundraising in thirty-five European countries, including an eleven-country subsample from Central and Eastern Europe (CEE). Using annual panel data for 2013–2022. Fixed-effects models were estimated for the full sample, while random-effects models were used for the CEE countries. In these models, total fintech fundraising is the dependent variable, and the five GII subindices are the independent variables. The coefficients for Knowledge Workers, Knowledge Impact, and Business Environment are negative and statistically significant, and their effect sizes are even larger in the CEE subsample. The results suggest that improvements in the analysed factors do not necessarily lead to increased market funding for start-ups. The findings indicate that strengthening these dimensions of innovation does not automatically boost market funding for fintech start-ups. The study enriches the fintech fundraising literature by showing that improvements in the analysed factors do not translate into greater market funding for start-ups. As the study is limited to European data from 2013 to 2022, future research could extend the geographic scope or incorporate additional variables.

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Introduction

The fintech (financial technology) start-up market developed at an impressive pace after the Global Financial Crisis (GFC) and achieved remarkable results until 2021. This was evident in the increasing scale of funding for this sector across Europe, the United States, and Asia. In particular, 2021 was a breakthrough year, as record levels of funding were reached for fintech start-ups through Venture Capital (VC) funds. It was a year marked not only by the highest amounts of capital raised but also by a record number of transactions and a significant number of mega funding rounds. However, since 2022, there has been a noticeable return to the funding levels observed before 2021 (CB Insights 2022; 2024), with a reduction in the amount of investment capital directed toward new technologies in the financial industry. The 2022 fintech fund-raising downturn coincided with rapid policy-rate hikes that tightened financial conditions and curtailed venture capital activity, especially late-stage and non-traditional participation (Atomico 2023; European Central Bank 2023). Globally, venture capital investment decreased by approximately 35 per cent in 2022 and continued to be subdued in 2023 (CB Insights 2024). In Europe, aggregate investment in 2023 was projected to be around 45 billion dollars, significantly below the levels recorded in 2021.

Understanding what drives fintech fundraising in Europe matters for public policymakers, who must target scarce innovation resources and regulatory effort. Knowing which parts of a country's innovation system convert into private capital for startups, and which do not, guides proportionate rules, entrepreneurship support, public co-investment, data access, and education. It also helps anticipate shifts of capital toward other tech sectors. France's Plan Tibi, led by Professor Philippe Tibi, shows how policy can mobilise institutional investors for technology firms (Direction générale du Trésor 2024; 2025). This study links Global Innovation Index (GII) sub-indices with observed fintech fundraising across Europe, including Central and Eastern Europe (CEE), to demonstrate the relationship between scores on specific dimensions and the total amount of fundraising in the fintech sector.

The development of the fintech industry is driven by enabling technologies, most notably the extensive application of artificial intelligence, blockchain, and 5G (Saiyed 2025). As a result, enterprises in this sector are increasingly adopting artificial intelligence (AI) solutions (Zhang, Ashta, and Barton 2021; Jain, Prajapati, and Dangi 2023). AI is revolutionising the strategic operations of financial institutions by compelling them to be more open and collaborative (Ashta and Herrmann 2021). Fintech companies use these technologies to develop new services, including providing AI as a service to financial institutions (Zhang, Ashta, and Barton 2021). These offerings primarily include credit scoring, where multiple data points streamline decision-making and mitigate default risk, and fraud detection and prevention (including AML – Anti-Money Laundering and KYC – Know Your Customer). They also include investment advice, where recommendation algorithms use market data and investor preferences, and automated customer support systems based on chatbots and conversational interfaces that facilitate user interactions. In addition, AI applications are widely used in personal financial management (Maple et al. 2023; Kamuangu 2024; Priyanka 2024; Saiyed 2025). Fintechs compete based on the quality of their solutions, including the ability to implement machine learning

(Zhang, Ashta, and Barton 2021; Maple et al. 2023; World Economic Forum 2025), which directly affects their ability to attract capital.

Existing cross-country studies show that fintech activity and funding are associated with measures of innovation capacity (Haddad and Hornuf 2019; Laidroo and Avarmaa 2020; Cojoianu et al. 2023) and institutional quality (including regulatory frameworks) (Claessens et al. 2018; Cornelli et al. 2021; 2024) and venture capital availability (Cumming and Schwienbacher 2018; Haddad and Hornuf 2019; Kolokas et al. 2022). At the same time, the World Bank's (2022) report points to large cross-regional heterogeneity and the possibility that the same enabling conditions may support other technology sectors more than fintech, especially in smaller or emerging economies. While this strand of the literature has significantly improved our understanding of the macroeconomic, technological, and institutional determinants of fintech activity, several specific gaps remain. Many cross-country measures capture activity or adoption rather than equity fundraising (World Bank 2022; Golder et al. 2025).

The World Bank's composite Fintech Activity Index itself notes measurement constraints, a cross-sectional design and the exclusion of fast-evolving segments (World Bank 2022). In addition, the enabling environment is usually captured through a relatively narrow set of indicators such as GDP *per capita* (Ivanova et al. 2017), venture capital intensity (Kolokas et al. 2022; Alaassar, Mention, and Aas 2023) or internet penetration, instead of analysing national innovation systems as multidimensional configurations of institutions, human capital, infrastructure, market sophistication, and business sophistication (Ryu 2025). Similarly, Haddad and Hornuf (2019) explain fintech emergence using GDP, venture capital availability, and digital infrastructure indicators, reflecting a macroeconomic rather than systemic view of innovation. Global evidence on fintech equity funding also relies on aggregated patterns and macro-level drivers, providing only limited region-specific insights for Europe, particularly for CEE (Cornelli et al. 2021). While regional analyses confirm that contextual factors shape fintech development, they seldom link these conditions to cross-country differences in fundraising outcomes within subregions (Zarrouk, Ghak, and Bakhouche 2021).

These gaps highlight a research problem: despite extensive evidence on the macroeconomic and institutional drivers of fintech activity (Cumming and Schwienbacher 2018; Haddad and Hornuf 2019; Cornelli et al. 2021), there is limited understanding of whether improvements in innovation system components, such as business environment, human capital, investment conditions, and knowledge creation, translate into greater equity fundraising for fintech start-ups (Van Roy and Nepelski 2017; Cojoianu et al. 2023; World Intellectual Property Organization 2023b). Existing research seldom examines how these multidimensional factors shape the fundraising landscape across European economies or whether their effects differ between advanced and emerging innovation contexts such as CEE (Cornelli et al. 2021; Zarrouk, Ghak, and Bakhouche 2021; Kolokas et al. 2022).

The main aim of this study is to examine the association between four GII subindices (Business Environment, Education, Knowledge Workers, Knowledge Impact) and the total value of fintech fundraising across 35 European economies from 2013 to 2022, including a CEE subsample.

The fintech literature has expanded rapidly in recent years (Milian, Spinola, and Carvalho 2019; Kumari and Chitra Devi 2022; Niewinska 2023), mostly highlighting the sector's transformative impact on traditional financial services (Gomber, Koch, and Siering 2017; Moccia, Passerini, and Tomic 2018; Natarajan 2020; Cornelli et al. 2021; Harasim 2021). Research has emphasised the role of innovation in driving fintech growth, particularly in terms of knowledge workers and technological output (Haddad and Hornuf 2019). A detailed citation analysis by Cumming, Johan, and Reardon (2023) revealed research gaps and emerging trends that link international business and fintech, underscoring the need for further exploration in this domain. (Haddad and Hornuf 2019) also found that the key factors for the successful emergence and funding of fintech start-ups were centred on well-developed economies and readily available venture capital. This analysis provides a better understanding of how GII factors affect the fundraising landscape in the European fintech sector.

The paper is structured as follows. Section 2 develops the theoretical background, while Section 3 provides related empirical evidence. Section 4 presents the data and methods, Section 5 reports results, Section 6 discusses implications, and Section 7 concludes.

Theoretical background

Several strands of economic and management theory (Freeman 1995; Hall and Soskice 2001; Audretsch and Keilbach 2007; Lundvall 2007; Spigel 2017) provide a foundation for examining how a country's innovation environment influences fintech fundraising (Jeng and Wells 2000; Hall and Soskice 2001). In particular, this study draws on Innovation Systems Theory, the Entrepreneurial Ecosystem perspective, Institutional Theory (North 1990; Freeman 1995; OECD 2002; Lundvall 2007), and the resource-based view (RBV) from strategic management and venture capital perspectives (Cumming and Schwienbacher 2018; Da Rin and Penas 2019; Jeng and Wells 2000; Hall and Soskice 2001; Kolokas et al. 2022; Turki and Rieg 2023). Collectively, these frameworks suggest that a country's innovation environment, encompassing its human capital, knowledge production, business environment, and institutional quality, plays a critical role in shaping entrepreneurial outcomes, such as startup funding (Etzkowitz and Leydesdorff 2000; Jeng and Wells 2000; OECD 2002; World Intellectual Property Organization 2023b). This section outlines each theoretical lens and links it to the study's research problems, which posit that GII sub-indices (Knowledge Workers, Knowledge Impact, Business Environment, Education) determine fintech fundraising.

Innovation Systems Theory

Innovation Systems Theory conceptualises innovation outcomes as the result of systemic interactions among firms, universities, and government institutions, rather than isolated firm-level efforts (Freeman 1995; OECD 2002; Lundvall 2007). Innovation capacity depends on the coherence and complementarity of knowledge production, education systems, and industrial application (Nelson 1993; Edquist 2009). In this view, entrepreneurial success depends not only on technological inputs but also on the alignment between scientific, regulatory, and market subsystems (Etzkowitz and Leydesdorff 2000; Al-Mannaei et al. 2023). For fintech, this implies

that human capital and innovation outputs must operate within enabling financial and regulatory contexts to generate investable opportunities (Tello-Gamarra et al. 2022; Bhutto, Jamal, and Ullah 2023; Baig et al. 2025). The link to this study is direct: the GII sub-indices of Education, Knowledge Workers, and Knowledge Impact capture central input–output components of national innovation systems, while Business Environment reflects the institutional infrastructure needed to mobilise and commercialise these capabilities (OECD 2002). Systems theory also anticipates outcome heterogeneity across countries, since similar innovation inputs can yield different sectoral results depending on the quality of linkages and the absorptive capacity of entrepreneurial actors (Tödtling and Trippl 2005; Audretsch and Keilbach 2007).

Institutional Theory

Institutional theory sees institutions as the formal rules and their enforcement that shape incentives and reduce uncertainty for economic actors (North 1990). When laws are clear, contracts are enforced, and regulation is predictable, investors face lower risk and lower transaction costs, so they are more willing to finance young firms (Jeng and Wells 2000; Cumming and Schwienbacher 2018). The Business Environment sub-indices can serve as a country-level proxy for these conditions because they reflect ease of entry, investor protection, and regulatory quality (OECD 2002).

Resource-Based View (RBV) and strategic management

The Resource-Based View (RBV) theory explains sustained performance by the possession and deployment of resources and capabilities that are valuable, rare, and difficult to imitate, and by an organisation that enables value capture (Wernerfelt 1984; Barney 2001; Bömer and Schwienbacher 2018). In entrepreneurial finance, investors allocate capital to ventures that credibly assemble such resource bundles, while venture capital helps discover and scale them through screening, staging, and value-adding support that reduces uncertainty (Gompers and Lerner 1996; Jeng and Wells 2000). When applied to fintech, salient resources include specialised finance and software skills, data and analytical know-how, and routines for rapid product iteration. Evidence shows that locations that combine strong financial institutions with strong software industries attract more venture investments in fintech (Bömer and Schwienbacher 2018). In our framework, Education and Knowledge Workers proxy the national stock of talent as core resources, Knowledge Impact captures the translation of research into outputs that investors can evaluate, and Business Environment reflects frictions that determine whether these resources are mobilised into equity fundraising.

Related empirical evidence

Building on the above theories, the following sections review the empirical evidence on fintech fundraising around three thematic drivers: (1) institutional quality and regulatory environment, (2) knowledge, innovation and human capital factors, and (3) market structure and financial ecosystem factors. The literature shows that these drivers shape the volume of equity raised by fintech start-ups (Cumming and Schwienbacher 2018; Cornelli et al. 2021; Cojoianu et al. 2023).

Institutional quality and regulatory environment

Empirical studies link stronger legal and regulatory environments with higher fintech investment. Scholars emphasise that better regulations and higher-quality institutional governance are conducive to greater investments in fintech companies. Investments in this sector have grown dynamically since 2010 in countries characterised by a higher capacity for innovation and better legal and regulatory infrastructure (Cornelli et al. 2021). At the same time, earlier studies by La Porta and Shleifer (2008) and Demirgüç-Kunt and Levine (2018) emphasise the importance of the rule of law and the quality of institutions for the overall level of investment in the financial sector. The introduction of mechanisms such as regulatory sandboxes has a positive impact on the fundraising potential of fintech companies, favouring innovation and investment. Firms admitted to regulatory sandboxes raise 15% more capital and are roughly 50% more likely to secure funding relative to comparable firms outside the sandbox (Cornelli et al. 2021; 2024). These findings align with institutional theory and support treating Business Environment (BE) as a country-level proxy for institutional quality in fundraising analyses.

RQ1: Is the quality of the business environment (BE) associated with the total value of fintech deals?

Knowledge, Innovation, and Human Capital Factors (Knowledge Spillovers)

Evidence indicates that the creation and diffusion of technological knowledge are central to fintech emergence and financing. According to Cojoianu et al. (2023), the creation and diffusion of technological knowledge (e.g., in the IT sector) is crucial for the emergence and development of fintech start-ups. This corresponds to the Theory of Knowledge Spillover Entrepreneurship, which posits that new ventures commercialise locally generated knowledge, converting it into entrepreneurial outcomes and investment (Audretsch and Keilbach 2007). However, in some cases, high labour costs and the unique conditions of the local market may limit the scale of funding, which indicates the complexity of the relationship between the availability of highly qualified specialists and the amount of funds raised. The business environment and the level of trust in incumbent financial institutions also affect the scale of investment. Low levels of trust may encourage entrepreneurs to seek innovative solutions. At the same time, historically distrustful regions tend to attract less capital (Cojoianu et al. 2023). In the context of key competencies, it is emphasised that experience in finance and IT has a greater consequence for fintech success than experience in the banking sector (Turki and Rieg 2023). In Poland, uncertainty about the availability of qualified employees and the lack of appropriate legal regulations have proven a particular barrier to development (Kliber et al. 2021). These insights motivate modelling Education (E), Knowledge Workers (KW) and Knowledge Impact (KI) as separate innovation dimensions linked to fundraising.

RQ2: Is a country's education level (E) associated with the total value of fintech deals?

RQ3: Are knowledge workers (KW) associated with the total value of fintech deals?

RQ4: Is knowledge impact (KI) associated with the total value of fintech deals?

Market structure and entrepreneurial finance

Market structure shapes how institutional and knowledge conditions translate into capital flows. Several other factors that shape fintech ecosystems are also highlighted in the literature. For example, countries with well-developed economies and easily accessible venture capitalists have more fintech start-ups (Haddad and Hornuf 2019). In turn, greater difficulties in accessing bank loans favour the development of fintech companies in a given country (Haddad and Hornuf 2019). The volume of investment in innovative sectors (including fintech) is also significantly influenced by macroeconomic factors such as GDP growth (Kassner 2024). Early-stage investor presence matters for the funding path. Fintech firms backed at seed or by angel investors are more likely to raise follow-on rounds, while single-founder start-ups face lower fundraising odds (Herck Giaquinto and Bruscato Bortoluzzo 2020). Interactions with incumbents are also relevant. Acquisitions by large banks can have a positive impact on fundraising, especially in the early stages of fintech development, whereas similar decisions taken by large technology corporations usually do not result in similar growth (Cornelli et al. 2021). These patterns imply that the effect of institutional and knowledge drivers will differ across European subregions with distinct investor bases and financial structures.

RQ5: Do these associations differ in magnitude between CEE and the rest of Europe?

Synthesis and regional heterogeneity in Europe

The literature confirms that fintech development and fundraising are shaped by multiple determinants. Institutional and regulatory quality, together with a supportive business environment, are central to investment outcomes (Demirgüç-Kunt and Levine 2018; Cornelli et al. 2021). It is evident that knowledge creation, human capital, and IT capabilities are particularly relevant for fundraising in the fintech sector (Audretsch and Keilbach 2007; Cojoianu et al. 2023). Furthermore, trust in incumbent financial institutions is instrumental in determining how knowledge spillovers translate into entrepreneurial finance (Audretsch and Keilbach 2007; Khlystova, Kalyuzhnova, and Belitski 2022; Cojoianu et al. 2023). The emphasis is placed not only on the relevance of regulations regarding the fintech sector and human capital, but also on the role of macroeconomic conditions, trust in traditional financial services, and the capacity of innovative organisations to attract funding (Alaassar, Mention, and Aas 2021; Vijayagopal, Jain, and Viswanathan 2024; Al-Assaf, Abdel-Halim, and Shehadeh 2025). All the above points to the need for a more integrated and multidimensional approach to examining factors that are conducive to the development and financing of fintech companies in Europe. Market structure further shapes transmission channels through venture capital depth, bank-credit constraints, and the presence of early investors and exit routes (Haddad and Hornuf 2019; Herck Giaquinto and Bruscato Bortoluzzo 2020; Cornelli et al. 2021). Evidence from the European Union shows that better access to financing, limited bureaucracy, a coherent political system, a favourable entrepreneurship education system, and high-quality protection of intellectual property rights tend to be associated with a greater share of high-tech companies (Van Roy and Nepelski 2017). Cross-regional analyses also point to substantial heterogeneity in the effectiveness of enabling conditions, which motivated us to test whether the associations documented above differ between CEE and the rest of Europe (World Bank 2022).

Data and methodology

The main aim of this study is to identify the factors that influence the total size of deals by fintech companies in European countries and in the CEE region. The methodology employed was a regression model applied to a panel dataset containing annual data from 2013 to 2022 for different European countries. The dependent variable is total deal size, measured in millions of USD, which represents the total amount of money raised by fintech companies in a given country and year. The independent variables are derived from the GII and include sub-indices related to business environment, education, investment, knowledge workers, and knowledge impact.

Dependent variables

The dependent variable in this study is the total value of capital raised by companies in the fintech sector in a given country and year (Total deal size – name of variable: TOTALDEALS). Data were obtained from the PitchBook database using the following filters: companies were selected from the "Analyst-Curated Verticals: FinTech" category, taking into account entities founded in the period between 2009 and 2023, while the limitation of data from independent variables resulted in the extraction of annual data for 35 European countries in the period 2013–2022. Total funding is expressed in millions of US dollars and represents the amount of funds raised in a given year by the fintech sector in each of the analysed countries. This variable allows us to assess the scale of funding provided to innovative financial ventures and shows the pace of development of the fintech market in individual countries.

Independent variables

Selected sub-indices from the GII developed and published by the WIPO served as the independent variables. Each variable reflects a different dimension of innovation potential and conditions that are conducive to the creation and development of new technologies through the financing of companies in the fintech sector. This will allow us to capture the complexity and assess whether better quality education, business ecosystem, investment, and knowledge affect the level of financing (World Intellectual Property Organization 2023a).

Business Environment (name of variable: BE) – a variable from the institution index group. It considers various aspects related to the quality of the institutional environment, such as starting a business, investor protection regulations, and the efficiency and effectiveness of solving problems related to enterprise insolvency. Better institutional conditions contribute to the development of entrepreneurship and attract capital, creating a favourable environment for entities from the fintech sector.

Education (name of variable: E): a variable from the Human Capital and Research index group that focuses on the quality and scope of the educational system. It considers, *inter alia*, expenditure on education, school life expectancy, results in international tests (e.g., PISA), and the available funding per student. A high level of education and an extensive base of human capital are conducive to devising innovative solutions whose adoption and commercialisation – also in the fintech sector – depend on the availability of highly qualified staff.

Investment (name of variable: I): a variable from the Market Sophistication index group that covers market conditions and dynamics, including the effective protection of minority investors and the level of investment activity (e.g., VC investments). Greater market sophistication translates into better conditions for raising capital for innovative ventures, including fintech companies, thus creating a favourable environment for the development of new business models.

Knowledge Workers (name of variable: KW): A variable from the Business Sophistication index group that relates to the intensity of intellectual capital and level of advancement of the business sector. It considers the availability of highly qualified workers, employment in knowledge-based sectors, research and development (R&D) expenditure, and the employment of women with higher education. Greater business sophistication indicates the possibility of fintech companies effectively creating, testing, and implementing innovations, which may translate into greater funding.

Knowledge Impact (name of variable: KI): a variable from the knowledge and technology output index group. It measures the effectiveness of innovation processes, considering, *inter alia*, increased labour productivity, the dynamics of new enterprise creation, software expenditure, standards quality (ISO certifications), and the production of high-tech goods. A high level of innovation activity can stimulate the development and financing of fintech enterprises through increased market attractiveness and improved innovation infrastructure.

These independent variables are analysed jointly in terms of the impact of various aspects of the innovation environment on fintech companies' ability to raise capital.

Table 1. Main Descriptive Statistics

	Mean	Std. Dev.	min	max	N
DEALS	451.53	903.30	1.00	6 391	350
TOTALDEALS	1 444.02	4 139.91	0.03	42 125.19	350
KW	54.57	12.36	25.80	81.80	350
KI	44.04	8.86	15.60	75.30	350
BE	76.35	13.09	17.90	93.10	350
E	58.27	8.19	35.30	86.30	350
I	39.56	16.54	1.40	96.20	350
ln DEALS	4.93	1.62	0.00	8.76	350
ln TOTALDEALS	5.04	2.54	– 3.51	10.65	350
ln KW	3.97	.24	3.25	4.40	350
ln KI	3.76	.21	2.75	4.32	350
ln BE	4.31	.23	2.89	4.53	350
ln E	4.06	.14	3.56	4.46	350
ln I	3.56	.58	0.34	4.57	350

Total number of deals – DEALS, Total deal size – TOTALDEALS, Knowledge Workers – KW, Knowledge Impact – KI, Business Environment – BE, Education – E, Investment – I.

Source: own calculations.

Table 1 presents the descriptive statistics of the variables under study and reveals significant diversity among European countries in terms of fintech market activity. An analysis of the total number of deals (DEALS) shows that, while some countries saw only one transaction, others recorded as many as 6,391, with an average of around 450 per year. Similarly, there are differences in the total deal size (TOTALDEALS): the lowest annual amount was just USD 0.03 million, while the highest exceeded USD 42,125.19 million. The data for the GII indicators (Knowledge Workers – KW, Knowledge Impact – KI, Business Environment – BE, Education – E, Investment – I), measured on a scale of 0–100, also show considerable variation, with the average values as follows: 54.57 (Knowledge Workers), 44.04 (Knowledge Impact), 76.35 (Business Environment), 58.27 (Education), and 39.56 (Investment). The minimum and maximum values of these sub-indices again illustrate the high degree of variability in the conditions for innovation in the countries studied.

Given the longitudinal structure of the dataset, we analyse the impact of country-level innovation factors on fintech fundraising with panel regression techniques. The dependent variable is the natural logarithm of total deal size, ln TOTALDEALS, measured as the annual USD value of fintech fundraising rounds in each country. All five explanatory variables are likewise expressed in natural logarithms: ln KW (Knowledge Workers), ln KI (Knowledge Impact), ln BE (Business Environment), ln E (Education) and ln I (Investment). The empirical sample covers 35 European countries observed annually between 2013 and 2022. To examine regional diversity, we estimate models based on (i) the full European panel and (ii) a CEE subsample, as defined by the Organisation for Economic Co-operation and Development (OECD).

Single-equation panel models that do not include lagged endogenous terms are estimated by the Generalised Least Squares approach in two variants: fixed-effects (FE) and random-effects (RE) (Dańska-Borsiak 2011). Pearson correlation diagnostics guided the final variable set (Table 2 and Table 3). Model selection between FE and RE relies on the Hausman test, while Breusch-Pagan Lagrange multiplier tests confirm the relevance of panel estimators over pooled OLS.

To further examine potential multicollinearity among the explanatory variables, Variance Inflation Factors (VIF) were calculated for all GII sub-indices. The VIF values ranged from 1.09 to 2.04, which is well below commonly accepted thresholds. These results confirm the absence of problematic collinearity after removing the Investment (I) sub-index, which was highly correlated with the Business Environment (BE) index, as also shown in Tables 2 and 3. The complete VIF statistics are presented in Table A1 in the Appendix.

Table 2. Pearson's correlation coefficients and statistical significance for Europe

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) ln_DEALS	1.000						
(2) ln_TOTALDEALS	0.901***	1.000					
	(0.000)						
(3) ln_KW	0.572***	0.601***	1.000				
	(0.000)	(0.000)					

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(4) ln_KI	0.218***	0.117**	0.162***	1.000			
	(0.000)	(0.028)	(0.002)				
(5) ln_BE	0.253***	0.177***	0.363***	0.162***	1.000		
	(0.000)	(0.001)	(0.000)	(0.002)			
(6) ln_E	0.196***	0.267***	0.493***	−0.105*	0.162***	1.000	
	(0.000)	(0.000)	(0.000)	(0.050)	(0.002)		
(7) ln_I	0.271***	0.235***	0.439***	0.123**	0.681***	0.152***	1.000
	(0.000)	(0.000)	(0.000)	(0.022)	(0.000)	(0.004)	

*** p < 0.01, ** p < 0.05, * p < 0.1.

Source: own calculations.

Table 3. Pearson's correlation coefficients and statistical significance for the CEE region

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) ln_DEALS	1.000						
(2) ln_TOTALDEALS	0.901***	1.000					
	(0.000)						
(3) ln_KW	0.572***	0.601***	1.000				
	(0.000)	(0.000)					
(4) ln_KI	0.218***	0.117**	0.162***	1.000			
	(0.000)	(0.028)	(0.002)				
(5) ln_BE	0.253***	0.177***	0.363***	0.162***	1.000		
	(0.000)	(0.001)	(0.000)	(0.002)			
(6) ln_E	0.196***	0.267***	0.493***	−0.105*	0.162***	1.000	
	(0.000)	(0.000)	(0.000)	(0.050)	(0.002)		
(7) ln_I	0.271***	0.235***	0.439***	0.123**	0.681***	0.152***	1.000
	(0.000)	(0.000)	(0.000)	(0.022)	(0.000)	(0.004)	

*** p < 0.01, ** p < 0.05, * p < 0.1.

Source: own calculations.

Two tests are used to check the significance of the group effects in the above panel models: the Wald test and the Lagrange multiplier test. These tests assess whether the proposed research method is justified (Dańska-Borsiak 2011). Based on the results of these tests, all null hypotheses are rejected, confirming the legitimacy of using panel models with group effects (FE and RE models). Ultimately, a fixed-effects (FE) model was used in the final stage of the analysis.

The general equation used in these models is as follows:

$$\ln TOTALDEALS_{it} = \beta 0 + \beta 1 \ln KW_{it} + \beta 2 \ln KI_{it} + \beta 3 \ln BE_{it} + \beta 4 \ln E_{\mathrm{it}} + \alpha_i + \lambda_t + \varepsilon_{it}, \quad \mathbf{i} = 1, \ldots, \mathbf{N}, \mathbf{t} = 1, \ldots, \mathbf{T} \tag{1}$$

where:
$\ln TOTALDEALS_{it}$ is the natural logarithm of the total amount of capital (expressed in millions of US dollars) raised by fintech start-ups in country *i* during year *t*;
$\ln KW_{it}$ denotes the natural logarithm of the Knowledge Workers index, which captures the proportion and quality of highly skilled labour available for innovation and technology-intensive activities in a given country-year;
$\ln KI_{it}$ is the natural logarithm of the Knowledge Impact index, reflecting how effectively a country converts research and knowledge into high-tech output, productivity gains and other tangible innovation outcomes;
$\ln BE_{it}$ is the natural logarithm of the Business Environment index; this variable measures institutional and regulatory quality, including ease of doing business, investor protection and the overall strength of financial and legal infrastructure;
$\ln E_{it}$ is the natural logarithm of the Education index, summarising the breadth and quality of a country's education system, such as expenditure per student, educational attainment, and learning outcomes;
$\beta 0$ is the common intercept term;
α_i is an unobserved country-specific effect that captures time-invariant characteristics of each country;
λ_t is a year-specific effect that absorbs shocks common to all countries in a given year;
ε_{it} is the idiosyncratic error term capturing all remaining unobserved influences on fintech fundraising in country *i* and year *t*.

Results

Table 4 presents the results of panel data estimations using FE and RE specifications. These models were applied to two separate samples: the full set of 35 European countries and a subsample consisting of the 11 CEE countries, defined according to the OECD classification. The dependent variable in all models is the natural logarithm of the total size of fintech deals (ln_TOTALDEALS), while the final independent variables include the logarithms of Knowledge Workers (ln_KW), Knowledge Impact (ln_KI), Business Environment (ln_BE), and Education (ln_E). All variables were transformed using natural logarithms. The FE model was chosen for the full European sample based on the Hausman test (p = 0.000), which indicated significant correlation between the regressors and the unobserved country-specific effects. For the CEE subsample, the Hausman test result (p = 0.318) confirmed the validity of using an RE model, as no such correlation was found. Consequently, the FE model is used to interpret the European results, while the RE specification is used for the CEE countries.

Serial correlation was assessed using a Wooldridge-type test for the FE model (F = 21.93, p = 0.000), which indicated first-order dependence in the residuals. Because serial correlation affects standard

errors but not the coefficient estimates, all FE results are presented with country-clustered robust standard errors (Drukker 2003). For the CEE subsample, the random-effects model reported an AR(1) coefficient of $\rho = 0.373$. These diagnostics are summarised in Table 4 below.

The findings from these four regressions allow us to address the following research questions:

RQ1: Does the size of fintech finance deals depend on the quality of a country's business environment?

The ln_BE coefficient is negative and statistically significant in both the European and CEE region models. In the European FE model, a 1% increase in the business environment index is associated with an average decrease in fintech deal size of 1.59%. A similar effect is observed in the CEE RE model, where a 1% increase in the business environment index influences an average decrease of 1.52%. These results suggest that better-developed business environments, which tend to be more stable and mature, do not necessarily attract higher levels of fintech investment.

RQ2: Does the level of education in a country affect the size of fintech deals?

The ln_E variable is not statistically significant in either model. Although the coefficient is negative in both cases, it does not reach conventional levels of significance. This suggests that the level of education, as measured by this index, does not systematically or clearly influence fintech fundraising across the countries examined. It may be that broader innovation capacity or practical skill development (e.g. tech entrepreneurship) is a more relevant factor in explaining capital allocation to fintech ventures than formal education metrics.

RQ3: Does the size of fintech financing deals depend on a country's knowledge workers?

In the European sample, the ln_KW variable is statistically significant and negative. A 1% increase in the knowledge worker index is associated with an average 2.32% decrease in fintech deal size. However, in the CEE RE model, this coefficient becomes statistically insignificant. This finding indicates that, at the broader European level, fintech fundraising tends to be lower in countries with more developed knowledge-intensive labour markets, potentially because these environments are already served by established players or are less open to disruption. In contrast, within the CEE region, the availability of knowledge workers does not appear to significantly influence fintech fundraising outcomes.

RQ4: Does the size of fintech financing deals depend on knowledge impact in the country?

The ln_KI coefficient is consistently negative and statistically significant in both models. In the European FE model, the elasticity is –1.81%, while in the CEE RE model it reaches –3.50%. These results show that countries with higher levels of technological output, research productivity, or innovation diffusion tend to have lower fintech fundraising volumes. One possible explanation is that in highly innovative economies, capital may be diverted toward other technology sectors that are perceived as more scalable or less regulated than financial technology.

RQ5: Do the relationships between innovation factors and fintech fundraising differ between Europe and the CEE region?

In both samples, stronger business environments and higher knowledge-impact scores are associated with smaller fintech deal volumes, but the elasticities are nearly twice as large in the CEE countries. This suggests that when institutional quality or innovation output improves in CEE, the market gaps that once favoured fintechs close more abruptly than in Western Europe and venture capital reallocates toward other, less regulated technology sectors. Consequently, better business conditions and stronger innovation performance do not draw additional fintech fundraising into the region.

These findings are consistent with previous research, suggesting that regions with lower trust in traditional financial services are characterised by greater funding for fintech start-ups, but regions with historically low trust attract less overall fintech investment (Cojoianu et al. 2021). By incorporating sub-indices from the GII, this study suggests that despite improvements in the business environment, education, and knowledge impact, VC fund managers may still favour well-established markets, reflecting broader trust and stability in these environments over purely improved sub-indices.

Table 4. Fixed-effects (FE) and random-effects (RE) panel data model results for the determinants of fintech fundraising in Europe and the CEE region

	Europe (full sample)		CEE region	
	FE	RE	FE	RE
ln_KW	−2.321**	0.469	−2.552*	−1.744
	(1.033)	(1.116)	(1.158)	(1.154)
ln_KI	−1.806***	−1.733***	−3.350**	−3.497***
	(0.645)	(0.614)	(1.266)	(1.168)
ln_BE	−1.592***	−1.373***	−1.663***	−1.519***
	(0.182)	(0.225)	(0.173)	(0.212)
ln_E	−1.057	−0.588	−2.762*	−1.928
	(0.829)	(0.891)	(1.279)	(1.186)
Constant	32.208***	18.007***	44.333***	37.841***
	(4.039)	(4.386)	(3.844)	(4.422)
Hausman p	0.000		0.318	
F test (alpha_i)	28.24***		18.00***	
BP LM p		0.000	.	0.000
Obs.	350	350	110	110
Adj. R^2	0.182		0.290	
Wooldridge F	21.93			
Wooldridge p	0.0000			
Coef L.e	0.247			
rho CEE RE				0.373

Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Source: own calculations.

The within R^2 for the European FE model is 0.182, indicating that the model explains approximately 18.2% of the within-country variation in fintech fundraising over time. The CEE RE model achieves a higher adjusted R^2 of 0.290, indicating greater explanatory power within this subsample. In both cases, the Breusch–Pagan Lagrange Multiplier test confirms the presence of significant panel effects ($p = 0.000$), justifying the use of panel models. The F-statistic for fixed effects in Europe is 28.24 ($p < 0.001$), and 18.00 ($p < 0.001$) for the CEE region, indicating strong significance of unobserved country-specific factors in both cases. These diagnostics reveal a substantial share of cross-country heterogeneity that is not captured by the independent variables alone but absorbed through fixed or random effects.

Discussion

Based on the fixed-effects panel models, this study shows significant correlations between the size of fintech sector financing (total deal size) and several factors included in the GII sub-indices. In particular, an increase in the knowledge workers and knowledge impact variables is statistically significantly correlated with a negative change in the total value of fintech transactions. A similar, although slightly weaker, trend was observed for business environment and education variables, while in the CEE subsample, the negative effects of knowledge impact and business environment are even stronger. This suggests that improvements in these areas more rapidly reduce the market space available for fintech solutions in less mature financial systems, which is consistent with the discussion on the multifaceted and system-level nature of factors shaping investments in the fintech sector discussed in the literature (Cojoianu et al. 2021; Turki and Rieg 2023).

These results confirm the complexity and interdisciplinary dimension of the determinants of fintech development, as observed by other scholars (Demirgüç-Kunt and Levine 2018; Demirgüç-Kunt et al. 2020; 2021; Cornelli et al. 2021). Cornelli et al. (2021) point to the key importance of regulatory support, including regulatory sandboxes. However, as our results show, increased knowledge or a better business environment alone does not guarantee a higher total value of investments in fintech. This pattern is particularly visible in the CEE countries, where higher values of both indices are associated with a decline in fundraising almost double that observed in the broader European sample. This may be because investors prefer to invest in markets with proven commercial potential, and not necessarily in sectors that show progressive improvement in innovation sub-indices. Cojoianu et al. (2021) draw a similar conclusion, noting that even in regions with low trust in traditional banking, in the absence of other favourable conditions, the scale of investments in fintech companies remains relatively limited.

Our research also shows that the Investment ("market sophistication") sub-index is not a factor that significantly affects the total value of funds raised by fintechs, a result that holds for both the full European panel and the CEE subsample. This is consistent with earlier observations by Haddad and Hornuf (2019), who observe that the availability of high-risk capital does not always boost fintech funding unless other factors, such as regulations or the general investment climate, also support its development.

The negative effects observed for Knowledge Workers, Knowledge Impact, Business Environment, and Education indicate that enhancements in these domains do not necessarily boost fintech fundraising. One potential explanation is that when early-stage and growth finance is limited or dispersed across a range of investor types, additional innovation capacity is directed towards developed sectors or projects with more apparent commercial prospects. This finding is consistent with the evidence that investors tend to focus on ecosystems with proven scaling potential and stable deal flow (Haddad and Hornuf 2019; Demirgüç-Kunt et al. 2020; Cornelli et al. 2021). Another explanation lies in institutions, where regulatory clarity and coherent governance matter more for entrepreneurial finance than isolated gains in education or knowledge creation (Demirgüç-Kunt and Levine 2018; Cornelli et al. 2021). In CEE markets, which are typically characterised by less developed capital markets and fintech ecosystems, poor coordination between regulation, supervision, and innovation policy raises perceived risk, reduces market depth and absorptive capacity, and deters investor commitments (Cojoianu et al. 2023; Turki and Rieg 2023).

Conclusions

In addressing the identified gaps, limitations, and recommendations, this paper enhances our understanding of the relationship between four GII subindices (Business Environment, Education, Knowledge Workers, Knowledge Impact) and the total value of fintech fundraising across 35 European economies and the CEE region between 2013–2022.

Theoretical contribution and managerial implications

While the conclusions of this study are practical, they also contribute to the existing body of knowledge. Specifically, the estimates indicate that higher scores in Business Environment, Knowledge Workers and Knowledge Impact are negatively associated with total fintech fundraising in Europe, with larger elasticities in the CEE subsample, while Education is statistically insignificant. Thus, improvements in these dimensions are associated with lower, rather than higher, fintech equity flows within the sample period. This insight is especially relevant for governments and funds in CEE, where recent improvements in institutional and innovation indicators have been associated with declines in fintech fundraising rather than increases. This pattern is consistent with previous studies that emphasise the need for an integrated, system-level approach to developing the fintech sector and to innovation finance more broadly (Van Roy and Nepelski 2017; Haddad and Hornuf 2019; Cornelli et al. 2021; World Bank 2022; Cojoianu et al. 2023). Our results nuance this view by showing that an increase in innovation and business climate indexes does not necessarily lead to fintech-specific equity flows.

In addition, the weakness or instability of regulations in certain countries (Kliber et al. 2021), persistent uncertainty in the availability of qualified staff, and shallow domestic venture capital markets can severely hinder the development of the fintech market, even when GII sub-indices improve (Haddad and Hornuf 2019; World Bank 2022). The negative associations observed are consistent with two mechanisms. First, high-innovation environments may experience market saturation and a displacement of capital toward other technology sectors. Second, regulatory clarity and the depth of venture markets appear to matter more for fintech fundraising than

incremental improvements in education or knowledge creation. This is particularly apparent in CEE countries, where dynamic changes in the GII sub-indices do not bring about the expected investment growth, in line with evidence on regulatory barriers, limited early-stage and scale-up finance, and the region's still nascent fintech ecosystem (Van Roy and Nepelski 2017; Kliber et al. 2021; Iwanicz-Drozdowska et al. 2023).

Limitations

A limitation of the analysis is its focus on European countries and the use of annual data spanning 2013 to 2022. Expanding the scope of this study to cover other regions of the world would allow us to ascertain whether the identified relationships are universal or specific to Europe. In particular, including non-European emerging markets could verify whether the stronger substitution effect observed in the CEE countries also arises outside the continent. Moreover, at the time of constructing the dataset, several of the most recent GII indicators were not yet available, which constrained the temporal coverage and precision of some innovation measures. Subsequently, it would be useful to include additional control variables (e.g., interest rates and digitalisation of the financial sector), as well as results obtained from **BIS** (Bank of International Settlements) research (Cornelli et al. 2021), analysing how mergers and acquisitions by large banks and large technology companies (BigTechs) affect fintech investment. This would offer a broader perspective and provide better insights for policymakers, investors, and the fintech sector itself.

Future research

Future research could extend this analysis in several directions. First, incorporating broader economic and sustainability-related aspects would align with recent studies that view fintech and related digital innovations through the lens of sustainable development, sectoral structure, and macro-financial performance (Barua et al. 2025; Golder and Barua 2025). Second, it could focus more explicitly on financing technology transfer from universities and public research institutes, including the role of university spin-offs, technology transfer offices, and public–private partnership schemes. This would build on existing literature on barriers to university technology transfer and entrepreneurial ecosystems (Van Roy and Nepelski 2017; Quiñones et al. 2020; Trinugroho et al. 2021). Third, combining firm- and deal-level data on fintech fundraising with regional indicators of knowledge creation and trust in incumbent financial institutions could reveal the micro-level mechanisms behind the country-level patterns documented in this study (Cojoianu et al. 2023). Finally, qualitative research, such as interviews with investors, fintech founders, and regulators in CEE and Western Europe, could provide further insight into how perceived regulatory risk, human capital constraints, and market structure influence strategic decisions regarding fintech investment and expansion (Ruhland and Wiese 2023; Panday, Nyawo, and Vilakazi 2024).

Appendix

Table A1. Variance Inflation Factors (VIF) for explanatory variables

Variable	VIF	1/VIF
ln_I	2.04	0.49
ln_BE	1.91	0.52
ln_KW	1.68	0.59
ln_E	1.40	0.72
ln_KI	1.09	0.92
Mean VIF	1.62	

Source: own calculations.

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Determinanty pozyskiwania finansowania fintechów w Europie

W artykule przeanalizowano wpływ pięciu subindeksów Global Innovation Index (GII) na łączną wartość transakcji finansujących start-upy w sektorze fintech w 35 krajach Europy, w tym w 11 krajach w regionie Europy Środkowo-Wschodniej (CEE). Zastosowano regresję panelową opartą na rocznych danych z lat 2013–2022. W analizie całej próby, czyli 35 krajów w Europie, przeprowadzono estymację przy użyciu modeli z efektami stałymi, natomiast w wyodrębnionej grupie państw CEE wybrano model z efektami losowymi. Zmienną zależną była łączna kwota finansowania fintechów, a zmiennymi objaśniającymi pięć subindeksów GII. Współczynniki dla zmiennych dotyczących pracowników wiedzy, wpływu wiedzy oraz otoczenia biznesowego okazały się ujemne i statystycznie istotne; efekt ten był jeszcze silniejszy w podpróbie CEE. Wyniki sugerują, że poprawa analizowanych czynników nie musi przekładać się na większe finansowanie rynkowe start-upów. Badanie wzbogacą literaturę dotyczącą pozyskiwania finansowania przedsiębiorstw, w szczególności sektora fintech, wskazując, że wzrost wartości badanych subindeksów GII nie gwarantuje wyższych poziomów inwestycji w młode przedsiębiorstwa. Ograniczeniem jest europejski zakres danych oraz okres obejmujący jedynie lata 2013–2022. Dalsze prace badawcze mogą rozszerzyć zasięg geograficzny lub uwzględnić dodatkowe zmienne.

Słowa kluczowe: fintech, pozyskiwanie kapitału, fundusze venture capital, inwestycje fintech, ekosystem innowacji