

Financial inclusion, entrepreneurial activity and the moderating role of human capital: new cross-country evidence

Thi Thu Tra Pham, Tung Bui Duy, Tuan Thanh Chu and
Trinh Nguyen

The Business School, RMIT University Vietnam, Ho Chi Minh City, Vietnam

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Abstract

Purpose – This study aims to reexamine the moderating role of human capital on the effect of extended financial inclusion (FI) for entrepreneurship, using data from the Global Entrepreneurship Monitor for a sample of 42 countries from 2006 to 2017.

Design/methodology/approach – This study distinguished between actual and perceived human capital. Actual human capital was measured through formal education while perceived human capital was captured by self-perceived capabilities for business start-ups. The moderating role of human capital was captured by the interaction terms between FI and human capital to investigate how the effects of FI on entrepreneurship vary with levels of human capital. The estimation used the panel-corrected standard error estimators and the two-step system generalized method of moments estimators.

Findings – Higher levels of formal education decrease the positive effect of extended FI on entrepreneurial activities. Individuals with high levels of self-capability do not leverage FI for entrepreneurial activities as much as those with lower levels of perceived capability. The results are robust to different estimation methods and different forms of actual human capital.

Research limitations/implications – Both financial and human capital matter for new business formation worldwide. The findings suggest that FI policies must account for the decreasing effect in response to high levels of human capital. Future research should explore different measures of entrepreneurial performance, various types of entrepreneurship and entrepreneurship across gender groups to gain deeper insights into strategies for promoting entrepreneurship.

Practical implications – Education strategies should focus on specific types of education, such as entrepreneurship education with financial literacy, rather than traditional academic curriculum, to foster entrepreneurship knowledge, skills and creativity. Likewise, entrepreneurship support schemes should aim to nurture and share appropriate levels of self-efficacy, avoiding excessively high self-efficacy, which is deleterious to the benefits of FI for entrepreneurial activities.

Originality/value – This study offers novel evidence of the decreasing effects of FI on entrepreneurial activities in response to increased actual and perceived human capital.

Keywords Formal education, Financial inclusion, Human capital, Entrepreneurship, GEM data

Paper type Research paper



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1. Introduction

Entrepreneurship is a key driver of productive activities and innovation, contributing to wealth creation through new economic opportunities (Wong *et al.*, 2005) and reduced poverty, especially among countries with low income and high inequality (Asongu and Odhiambo, 2023). Growth in entrepreneurial activities is influenced by various factors, including financial capital (Gregory, 2019; Demirgüç-Kunt and Singer, 2017), technology development and exchange (Nguyen Chau *et al.*, 2024), business opportunities and policy support (Schwab, 2018) and human capital associated with the ability to identify and take on new business opportunities (Koudstaal *et al.*, 2016; Hayward *et al.*, 2006).

Among these factors, financial capital plays a critical role, particularly through financial inclusion (FI) ensuring access to affordable financial services for individuals and businesses (Barajas *et al.*, 2020; Gregory, 2019). This has become an important policy goal for fostering entrepreneurship, especially in developing economies (Asongu and Odhiambo, 2023; Corrado and Corrado, 2017), where improved access to financial services such as credit, savings and insurance enables entrepreneurs to overcome resource constraints and capitalize on business opportunities. FI has been linked to new venture formation, job creation and social welfare across nations (Kim *et al.*, 2018; Grohmann *et al.*, 2018; Demirgüç-Kunt and Singer, 2017). This is the key rationale for efforts to improve the inclusiveness of financial systems among developing countries (Corrado and Corrado, 2017).

Despite a strong theoretical foundation, the positive effect of FI on entrepreneurship is not universally consistent. Empirical studies report mixed effects of FI on nascent entrepreneurship across regions and countries, including developed countries in Europe and the USA (Grilo and Thurik, 2005), developing countries in Africa (Ajide, 2020) and China (Cao and Zhang, 2022; Beck *et al.*, 2015). This inconsistency creates challenges in effectively allocating financial resources to support entrepreneurial growth. A possible reason for these varied effects is the role of human capital as a moderating factor. Although FI provides necessary resources, the way nascent entrepreneurs leverage them depends on their human capital.

There is also a rich literature discussing the effect of human capital on entrepreneurship. The literature distinguishes between actual human capital – measurable attributes such as formal education and technical skills – and perceived human capital or an individual's self-assessed capabilities (Dutta and Sobel, 2018; Liao and Welsch, 2008; Reynolds *et al.*, 2005; Davidsson and Honig, 2003). The human capital theory (Becker, 1964) and hubris theory (Hayward *et al.*, 2006) both suggest that while human capital is important in driving economic growth, higher levels of human capital are not always associated with increased entrepreneurial activities.

Previous research has extensively examined the relevance of both FI and human capital across different country contexts and in relation to various outcomes. For example, the cross-country study by Du *et al.* (2022) for 18 emerging countries demonstrates that environmental quality improves with increased FI but deteriorates with human capital. Similarly, Saydaliyev *et al.* (2022) demonstrate that for remittance-receiving countries, FI and human capital both promote economic growth. Several studies have also explored the relationship between FI and human capital. For instance, Thathsarani *et al.* (2021) conclude that while FI has a significant short-term impact on economic growth, it negatively affects the development of human capital in South Asian countries. In contrast, Huang *et al.* (2023) find that higher levels of FI, combined with reductions in income inequality, tended to enhance human capital in 36 sub-Saharan countries between 2004 and 2019.

However, the interaction between FI and human capital remains underexplored, leaving a critical gap in understanding how these factors interact to shape entrepreneurial outcomes. A

notable exception is the work of [Boachie and Adu-Darko \(2024\)](#), which explores how human capital development interacts with FI to drive economic growth. They find evidence supporting the positive moderating role of human capital, as its fundamental traits and acquired skills enhance both FI and economic growth. Despite insightful findings, the study does not account for different types of human capital attributes, focusing only on human capital stock. Moreover, their analysis is focused on economic growth rather than entrepreneurial outcomes, which could represent a specific conduct contributing to broader economic growth.

This study addresses this knowledge gap by examining the moderating role of human capital in the FI–entrepreneurship nexus. We propose that although FI generally supports entrepreneurship by reducing financial constraints, its effects may diminish as the levels of actual and perceived human capital increase. Specifically, individuals with higher levels of formal education (actual human capital) may face decreased incentives to pursue entrepreneurial activities, as education increases either their expected returns in entrepreneurial pursuits or risk aversion. Likewise, individuals with higher levels of perceived human capital may overestimate their self-capability and, as a result, underuse financial services designed to support entrepreneurship.

To investigate these relationships, this study uses data from the Global Entrepreneurship Monitor (GEM) for a sample of 42 countries spanning 2006–2017. The GEM data is available for measurements of nascent entrepreneurial activities, innovative entrepreneurial activities and perceived human capital through self-perceived capabilities. We gather data on actual human capital, such as formal education and the human development index and several controls, from World Development Indicators. FI is captured through a composite FI index following [Sarma's \(2012\)](#) approach using the data from the International Monetary Fund's Financial Access Surveys. Our econometric models for entrepreneurial activities incorporate interaction terms between FI and different forms of human capital to investigate how the effects of FI on entrepreneurship vary with levels of human capital. We apply the panel-corrected standard error (PCSE) estimator to control for heteroskedasticity. The study also uses the two-step system generalized method of moments (GMM) estimators to confirm the robustness of our results.

Our paper contributes to the existing literature on entrepreneurship and FI in several ways. First, we confirm the widely held belief that FI promotes entrepreneurship and entrepreneurial innovation among nascent entrepreneurs. Second, we extend the literature by highlighting that the effects of extended FI on entrepreneurship decrease among those with higher levels of formal education. In addition, we build on the hubris theory to highlight that a higher level of self-perceived capability decreases the effect of extended FI for entrepreneurship and entrepreneurial innovation. The findings will help inform government policies for monitoring the effects of FI on entrepreneurial outcomes.

The remainder of this paper is structured as follows. Section 2 reviews the literature on FI, human capital and entrepreneurship and develops the theoretical framework for the moderating role of human capital. Section 3 presents the data and empirical strategy, whereas Section 4 discusses the main results and robustness checks. Finally, Section 5 concludes the study.

2. Literature review and hypothesis construction

Entrepreneurship is crucial for economic growth, driving innovation and new business opportunities ([King and Levine, 1993](#)). It involves the ability of individuals to recognize and act on business opportunities, which requires a certain level of financial and human resources. Improved financial access assists in mobilizing and allocating necessary resources

to new entrepreneurs, allowing them to establish new businesses (King and Levine, 1993). Human capital matters as it provides the skills and knowledge required to perform entrepreneurial tasks (Davidsson and Honig, 2003). The following sections elaborate on the role of financial capital and human capital in fostering entrepreneurship.

2.1 Financial inclusion and entrepreneurship

Financial capital, which includes the availability and accessibility of financial resources, is essential to nurturing and promoting entrepreneurship in both developing and developed countries (Barajas *et al.*, 2020; Demirgüç-Kunt and Singer, 2017). FI supports entrepreneurship by providing nascent entrepreneurs with necessary financial resources (Dutta and Sobel, 2018; Bruhn and Love, 2014), encouraging well-planned business strategies and fostering efficient use of resources (Jiménez *et al.*, 2015). Several cross-country studies document the positive effects of FI across continents and countries, including Africa (Boachie and Adu-Darko, 2024; Ajide, 2020), developing Asian countries (Chowdhury and Chowdhury, 2024; Charfeddine and Zaouali, 2022) and Europe (Oyewole *et al.*, 2024). However, the relationship between FI and entrepreneurship remains inconclusive. Although many studies support a positive link (Barajas *et al.*, 2020), others suggest ambiguity in this relationship (Beck *et al.*, 2015; Grilo and Thurik, 2005).

The mixed findings on the role of FI on entrepreneurial outcomes can be attributed to differences in country cases, methodologies used and the absence of contextual factors governing the relationship. Most studies focus on single dimensions of FI, such as financial accessibility, financial availability or the usage of financial services (Angelucci *et al.*, 2015; Bruhn and Love, 2014). Although each dimension of FI is essential, a comprehensive metric considering all three dimensions can provide a more holistic and accurate assessment of the financial system's ability to support entrepreneurs and businesses (Cao and Zhang, 2022).

The first aim of this study is to reaffirm the positive role of FI toward entrepreneurship, using a composite index of all three dimensions, including accessibility, availability and usage. The study proposes the following hypothesis:

H1. Financial inclusion will promote entrepreneurial activities.

2.2 Human capital and entrepreneurship

Becker's (1964) human capital theory emphasizes the importance of education and training in fostering entrepreneurial growth and economic success. In entrepreneurship, human capital encompasses skills, knowledge and experience needed to identify and exploit business opportunities and to foster entrepreneurial alertness and endeavors (Dutta and Sobel, 2018; Brush *et al.*, 2017; Tang and Murphy, 2012). Strong human capital supports entrepreneurs in creating comprehensive business plans, managing risks and strategically positioning long-term ventures (Baum *et al.*, 2001). Furthermore, robust human capital enhances entrepreneurs' ability to secure the necessary resources, particularly valuable in the early stages of a venture (Brush *et al.*, 2001). Recent research distinguishes between actual and perceived human capital, expanding Becker's original concept.

Actual human capital refers to measurable attributes an individual possesses, such as formal education, work experience and specific technical skills. Formal education, in particular, is frequently explored in relation to entrepreneurship (Ahn and Winters, 2023; Debarliev *et al.*, 2022). It equips individuals with the skills and knowledge necessary for entrepreneurial success, fostering a growth mindset and enhancing entrepreneurial intentions and performance. Several cross-country and country-level analyses demonstrate that

countries with higher levels of education are associated with greater growth in entrepreneurship ratio (Ahn and Winters, 2023; Debarliev *et al.*, 2022; Unger *et al.*, 2011; Davidsson and Honig, 2003). The analysis for European countries by Millán *et al.* (2014) further suggests that entrepreneurship education instills creative and innovative abilities essential for entrepreneurship and innovation.

Perceived human capital involves individuals' self-assessment of their skills and capabilities (Gielnik *et al.*, 2020; Brush *et al.*, 2017). It is influenced by subjective perceptions and confidence in one's abilities, which can shape entrepreneurial motivation and actions. Those who believe they have the necessary skills and knowledge to start a business are more inclined to seek and use financial resources for entrepreneurship (Hartog *et al.*, 2010) and thus provide confidence to undertake the risk of entrepreneurship (Maczulskij and Viinikainen, 2023; Liao and Welsch, 2008; Reynolds *et al.*, 2005). Empirical evidence shows that perceived entrepreneurial ability motivates individuals to take concrete actions, transitioning from the idea phase to entrepreneurship success (Bachmann *et al.*, 2021; Gielnik *et al.*, 2020; Townsend *et al.*, 2010; McGee *et al.*, 2009), especially among women (Brush *et al.*, 2017). Recent cross-country analyses using GEM data by Yusuf *et al.* (2024) and Ali *et al.* (2023) further confirm that self-perceived capabilities are associated with greater growth in business start-ups across a range of countries. This study seeks to reaffirm the significant contribution of actual and perceived human capital to entrepreneurship. It presents the following hypotheses:

H2a. Formal education, as a measure of actual human capital, will promote entrepreneurial activities.

H2b. Self-capability for start-ups, a measure of perceived human capital, will promote entrepreneurial activities.

2.3. A further look into human capital

Although FI and human capital individually drive entrepreneurial activities, their interplay remains underexplored. This section draws upon the existing literature to examine how actual and perceived human capital might moderate the effect of FI on entrepreneurship.

2.3.1 The moderating role of actual human capital. Formal education, a notable measure of actual human capital, is often seen as enhancing the effects of FI on entrepreneurial growth by improving financial literacy, skills, knowledge and attitudes needed to make informed decisions about financial matters (Millán *et al.*, 2014). However, higher education levels may also dampen the benefits of extended FI for entrepreneurship.

There are several reasons for this. First, higher formal education implies greater expected returns on human capital investment (Becker, 1964). Facing the same level of opportunity, including those offered by financial services, those populations with higher levels of formal education may be less willing to pursue an entrepreneurial aspiration, as the perceived return on business opportunities may seem less attractive than employment opportunities (Malchow-Møller *et al.*, 2010). Second, higher levels of formal education can increase risk aversion by raising risk awareness for individuals (Jung, 2015), thereby reducing the chance of pursuing an entrepreneurial opportunity (Iyigun and Owen, 1998). Third, formal education might hinder the creative thinking necessary for entrepreneurship and innovation. As young people progress through school, individuals may become more focused on finding "correct answers" rather than exploring innovative ideas. Cross-country evidence by Jiménez *et al.* (2015) shows that entrepreneurship rates are significantly lower among

countries with high education levels, indicating that efforts to promote entrepreneurship would need to consider the role of education.

In brief, extensive formal education and its potential consequences, including an increased risk aversion, higher expected return on investment and reduced creative thinking, can mitigate the positive impact of FI on entrepreneurial activities. This leads to the following hypothesis:

- H3.* High levels of formal education will weaken the effect of financial inclusion on entrepreneurial activities.

2.3.2 The moderating role of perceived human capital. FI undoubtedly eases financial constraints for entrepreneurial growth. However, its effect might depend on the self-perceived human capital of the populations the financial system is targeting. We develop from the hubris entrepreneurship theory to suggest that high levels of self-capability or overconfidence may weaken the positive effects of FI on entrepreneurial growth.

The hubris entrepreneurship theory proposes that self-perceived capabilities add value to early-stage entrepreneurship (Hayward *et al.*, 2006). This is because high levels of self-capability can result in a cognitive bias, leading entrepreneurs to overestimate their chances of success and underestimate both the resources needed and potential risks involved in starting a new venture (Singh, 2020; Gielnik *et al.*, 2020; Brush *et al.*, 2017; Robinson and Marino, 2015). Therefore, overconfident entrepreneurs, driven by energy and commitment, often start businesses with limited resources (Robinson and Marino, 2015; McGee *et al.*, 2009; Koellinger *et al.*, 2007; Hayward *et al.*, 2006), making them less reliant on financial resources than those with lower self-perceived capabilities (Tsai *et al.*, 2016). Similarly, when tracking entrepreneurial growth, the number of start-up businesses often surges during the early stages when financial resources are scarce. However, this growth tapers off as resources become more plentiful over time. The recent cross-country analysis using GEM data by Brush *et al.* (2017) demonstrates that countries and populations with high levels of self-perceived capabilities often exhibit higher levels of new start-ups. However, this relationship cannot be found in established firms.

In light of these arguments, we propose the following hypothesis:

- H4.* Excessive perceived self-capability for start-ups will mitigate the effect of financial inclusion on entrepreneurial activities.

3. Data, empirical strategy and model specification

3.1 Data description

We collected and collated country-level data from multiple secondary sources. First, we used the GEM database to capture country-level data on entrepreneurship; perceived human capital; and perceived business opportunities and risks by potential entrepreneurs. These GEM data have been used by several recent cross-country studies focusing on self-perceived capabilities and entrepreneurship, including Yusuf *et al.* (2024), Sima (2023), Ali *et al.* (2023), Rietveld and Patel (2023), Brush *et al.* (2017), among others.

We captured nascent entrepreneurship and entrepreneurial innovations using two indicators from the Adult Population Surveys within the GEM data, which are consistent with our theoretical arguments in Section 2, and consistent with cross-country entrepreneurship analyses presented above. These include total early-stage entrepreneurial activity (TEA) rate, which measures the percentage of the 18–64 population who self-reported as a nascent entrepreneur or new business owner-manager and innovation rate

among new entrepreneurs (*INNO*), which measures the percentage of individuals offering products or services which are new to at least some customers. Perceived human capital was gauged by the proportion of the population aged 18–64 who believe they have the skills and knowledge to start a business (Yusuf *et al.*, 2024; Ali *et al.*, 2023; Brush *et al.*, 2017; Wong *et al.*, 2005). Following Yusuf *et al.* (2024) and Ali *et al.* (2023), we controlled for the effect of the fear of business failure and perceived business opportunities, sourced from GEM data.

Second, we used the Financial Access Survey from the IMF for constructing the FI index (*FI*). We followed Sarma (2012) to construct a composite FI index encompassing accessibility, availability and actual usage of financial systems. These three dimensions of FI are necessary for assessing the condition of FI in each economy and tracking the success of policy measures aimed at promoting FI. This comprehensive measure has been increasingly adopted by several country-level and cross-country studies (Tram *et al.*, 2023; Saha and Qin, 2023; Lenka, 2022; Cao and Zhang, 2022).

Third, we used the World Development Indicators to obtain country-level data on actual human capital and control variables for the analysis. Following recent studies into entrepreneurship, actual human capital was measured through formal education (Ahn and Winters, 2023; Debarliev *et al.*, 2022). We controlled for country-level GDP per capita as a source of physical capital for entrepreneurial growth (Yusuf *et al.*, 2024; Sima, 2023). Finally, we extended existing entrepreneurship literature by considering country-level trade openness as a source of technological innovation for entrepreneurial growth. Based on the latest data available, our final data consisted of an unbalanced sample covering 42 countries between 2006 and 2017. Table 1 presents a summary of variable definitions and sources.

3.2 Model specifications

Our baseline models for explaining country-level entrepreneurship (*TEA*, *INNO*) as a function of FI, human capital and other factors take the following forms:

$$TEA_{i,t} = \beta_0 + \beta_1 FI_{i,t-1} + \sum_{j=1}^j \alpha_j X_{j,i,t-1} + \varepsilon_{i,t} \quad (1)$$

$$INNO_{i,t} = \partial_0 + \partial_1 FI_{i,t-1} + \sum_{j=1}^j \gamma_j X_{j,i,t-1} + \varepsilon_{i,t} \quad (2)$$

where *TEA* and *INNO* are outcome variables representing the percentage of the population engaging in new businesses and new products/services, respectively. $X_{j,i,t-1}$ is a set of control variables influencing entrepreneurial growth, including *GDP* per capita as physical capital financing entrepreneurship (Yusuf *et al.*, 2024; Sima, 2023; Gregory, 2019), *Trade* (trade openness) as a source of technology transfer and exchange (Nguyen Chau *et al.*, 2024), *P_OP* (perceived business opportunities) to capture supporting policies and *FEAR_FAIL* (the fear of failure) to capture potential risks associated with business startups perceived by potential entrepreneurs (Yusuf *et al.*, 2024; Ali *et al.*, 2023). Following Rauch and Rijsdijk (2013) and Dutta and Sobel (2018), our independent variables were lagged to capture their delayed effects on entrepreneurial outcomes.

To examine how the effects on entrepreneurship of FI might differ in response to actual and perceived human capital, we extended our baseline models by introducing interactions between *FI* and *H_CAP* (actual human capital) and *P_CAP* (perceived human capital) stepwise using equations (3)–(6). Consistency in the estimates between models with and

Table 1. Variable definitions and measurement

Abbreviation	Variable	Definition	Source
TEA	New entrepreneurs (%)	Percentage of 18–64 population who are nascent entrepreneurs or managing a new business	GEM
INNO	Innovation rate (%)	Percentage of TEA offering new products/services to some customers	GEM
FI	Financial inclusion	Financial inclusion index	Author’s calculation from the financial access surveys (IMF)
H_CAP	Formal education (%)	Percentage of tertiary enrollments to the total population for each country	WDI
P_CAP	Perceived human capital (%)	Percentage of 18–64 population confident in their skills and knowledge to start a business	GEM
HDI	Human development index	Human Development Index	WDI
GDP	GDP per capita (\$US)	Per capita GDP	WDI
Trade	Trade openness (%)	Sum of exports and imports as a percentage of GDP	WDI
FEAR_FAIL	Fear of failure (%)	Percentage of 18–64 population who indicate that fear of failure would prevent them from setting up a business	GEM
P_OP	Perceived opportunities (%)	Percentage of 18–64 population seeing good opportunities to start a firm locally	GEM

Source: Authors’ own work

without interactions is important for interpreting our variables of interest. If the interactions between *FI* and *H_CAP* ($FI_{i,t-1} * H_CAP_{i,t-1}$) are statistically significant, we can conclude that the effects of *FI* on entrepreneurial outcomes (*TEA* or *INNO*) depend on the levels of education of the population. A similar interpretation applies to the interactions between *FI* and *P_CAP*. Furthermore, we also checked the robustness of these interactions by estimating a similar model using interactions between *FI* and the human development index (*HDI*):

$$TEA_{i,t} = \beta_0 + \beta_1 FI_{i,t-1} + \beta_2 H_CAP_{i,t-1} + \beta_3 FI_{i,t-1} * H_CAP_{i,t-1} + \sum_{j=1}^j \alpha_j X_{j,i,t-1} + \varepsilon_{i,t} \tag{3}$$

$$TEA_{i,t} = \beta_0 + \beta_1 FI_{i,t-1} + \beta_2 P_CAP_{i,t-1} + \beta_3 FI_{i,t-1} * P_CAP_{i,t-1} + \sum_{j=1}^j \alpha_j X_{j,i,t-1} + \varepsilon_{i,t} \tag{4}$$

$$INNO_{i,t} = \partial_0 + \partial_1 FI_{i,t-1} + \partial_2 H_CAP_{i,t-1} + \partial_3 FI_{i,t-1} * H_CAP_{i,t-1} + \sum_{j=1}^j \gamma_j X_{j,i,t-1} + \varepsilon_{i,t} \tag{5}$$

$$INNO_{i,t} = \partial_0 + \partial_1 FI_{i,t-1} + \partial_2 P_CAP_{i,t-1} + \partial_3 FI_{i,t-1} * P_CAP_{i,t-1} + \sum_{j=1}^j \gamma_j X_{j,i,t-1} + \varepsilon_{i,t} \quad (6)$$

3.3 Estimation techniques

This study used the PCSE estimators to estimate the parameters of equations (1)–(6). The PCSE estimators have been considered to provide the most reliable results for complex panel data where the data exhibit significant heterogeneity over time and across units (Bailey and Katz, 2011). This advantage from PCSE is particularly relevant for our panel because there are significant differences in unobserved factors potentially associated with growth in entrepreneurial activities across countries and across times. This PCSE method has been widely used by several researchers, including, but not limited to, Liu and Ma (2021) and Brodzicki *et al.* (2018).

Concerning alternative estimation methods, both the PCSE and GMM estimators allow autocorrelation within the panel, meaning that the growth of entrepreneurial activities of one country can be correlated over time. However, the GMM estimators generally fail to address within-country heterogeneity. This implies that if countries experienced significant changes in entrepreneurial growth and its driving factors, GEM estimators cannot predict entrepreneurial outcomes as effectively as their PCSE counterparts do. Therefore, the PCSE was our preferred method also this method might not be ideal if entrepreneurship within a country has its momentum over time. We also reported in Section 4 the GMM estimates using equations (1)–(6) as a robustness check.

4. Result discussions

4.1 Results for total early-stage entrepreneurial activity

Table 2 reports the estimation results of equations (1), (3) and 4 using TEA as the dependent variable. The estimates for the control variables are largely consistent in terms of sign, magnitude and statistical significance across models with and without interactions between FI and H_CAP and P_CAP. Trade openness is positively associated with greater entrepreneurial activities in all models, suggesting that a country's openness to international trade is likely to foster domestic entrepreneurial growth.

The consistent negative estimates for GDP per capita suggest that countries with higher GDP per capita tend to have lower rates of nascent entrepreneurship. This seemingly counterintuitive finding can be explained by factors like high market competition, opportunity cost for self-employment and business entry costs (Audretsch *et al.*, 2012). Recent research corroborates that developed countries typically exhibit low self-employment rates. A general decline in self-employment rates has been observed across 21 OECD European countries, particularly in Northern and Western Europe (Saridakis *et al.*, 2019). These findings align with prior research showing that developed countries such as Germany, France, the USA, Denmark, Sweden, Norway, Netherlands and Finland have low self-employment rates below 10% (Piotr and Rekowski, 2009). Conversely, perceived business opportunities (P_OP) consistently show positive impacts (0.274–0.564) across all models. With GDP and Trade controlled for, P_OP may capture the effect of policy rewards aimed at generating a dynamic business environment within countries. Thus, our results for P_OP align with existing literature emphasizing the role of social capital in entrepreneurship growth (Audretsch *et al.*, 2012).

The positive estimates for FI in Columns 1–4 suggest a complementary effect of FI on the TEA rate, confirming H1. This finding supports related literature contending that improved

Table 2. PCSE regression results with total early-stage entrepreneurial activity as the dependent variable

	Model specification (1)	Model specification (2)	Model specification (3)	Model specification (4)
L.FI	0.438*** (0.077)	1.051*** (0.083)	0.804*** (0.128)	1.153*** (0.070)
L.GDP	−0.248*** (0.028)	−0.398*** (0.027)	−0.254*** (0.024)	−0.574*** (0.035)
L.P_OP	0.564*** (0.034)	0.362*** (0.034)	0.274*** (0.033)	0.395*** (0.028)
L.FEAR_FAIL	0.229*** (0.055)	−0.223*** (0.051)	−0.249*** (0.058)	−0.353*** (0.048)
L.Trade	0.074 (0.140)	0.302*** (0.115)	0.331*** (0.123)	0.252** (0.108)
L.H_CAP		1.486*** (0.083)		
L.FI#L.H_CAP		−0.279*** (0.021)		
L.P_CAP			1.090*** (0.092)	
L.FI#L.P_CAP			−0.183*** (0.031)	
L.HDI				9.246*** (0.579)
L.FI#L.HDI				−1.369*** (0.092)
Number of observations	291	256	291	291
Number of groups	41	37	41	41
χ^2	13,285	27,637.8	21,169.6	26,564.1

Notes: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. Standard errors in parentheses. The table also reports the χ^2 of the modified Wald test for group-wise heteroscedasticity with the null hypothesis of homoscedasticity
Source: Authors' own work

financial services release financial constraints, enabling potential entrepreneurs to start businesses (Gregory, 2019; King and Levine, 1993). Moreover, increased FI, through improved financial and banking services, reduces transaction costs and information asymmetry, resulting in more incentives to set up a new business (Charfeddine and Zaouali, 2022).

Both actual human capital (*H_CAP*) and perceived human capital (*P_CAP*) exhibit positive effects on *TEA* across the models, confirming *H2a* and *H2b*. Formal education nurtures entrepreneurial intentions and attitudes, enhances entrepreneurial skills and knowledge to manage ventures (Unger et al., 2011) and contributes to entrepreneurship performance. Perceived capabilities (*P_CAP*) are positively associated with greater *TEA*, confirming existing literature emphasizing the role of self-confidence in business start-ups and entrepreneurship decisions (Maczulskij and Viinikainen, 2023; McGee et al., 2009). Our international panel evidence reinforces the argument that higher levels of human capital create a more dynamic entrepreneurial environment (Brush et al., 2017; Brush et al., 2001).

However, the negative interaction between *FI* and *H_CAP* (−0.279) confirms *H3*. This result is consistent when we introduced interactions between *FI* and the human capital index (*HDI*) in Column 4. While both *FI* and actual formal education positively impact entrepreneurial growth and business startups, the effect of extended *FI* decreases among better-educated populations. Higher education is associated with increased risk aversion, which can act as a barrier to entrepreneurial intentions despite improved *FI*. Recent studies suggest that while higher education enhances entrepreneurial knowledge and competencies, it often coincides with a declining intention toward entrepreneurship due to a preference for more secure career paths (Setyanti, 2021; Iyigun and Owen, 1998). Our cross-country evidence contradicts Millán et al. (2014), who argue that better-educated people make better use of financial services for business opportunities.

Similarly, the negative interaction between FI and P_CAP (−0.183) supports H4. The effect of extended FI on entrepreneurial growth is lower among those with high levels of self-perceived capability, consistent with the hubris entrepreneurship theory. Potential entrepreneurs, driven by energy and commitment, often start businesses with limited resources (Robinson and Marino, 2015; Koellinger *et al.*, 2007; Hayward *et al.*, 2006), making them less reliant on financial resources than those with lower self-perceived capabilities (Tsai *et al.*, 2016). Therefore, we expect to see lower effects when FI is improved in the populations with high levels of perceived capabilities. In addition, when observing populations with high levels of self-perceived capabilities, the number of start-up businesses often surges during the early stages when financial resources are scarce. However, this growth tapers off as resources become more plentiful over time.

4.2 Results for innovative total early-stage entrepreneurial activity

Next, we examine whether human capital reduces the positive effect of extended FI for innovative entrepreneurship (INNO) by estimating equations (2), (5) and (6). This variable captures whether new business start-ups involve new products and services. The results are reported in Table 3. Most control variables, including GDP, P_OP, yield consistent results with those presented in Table 2 where TEA was the dependent variable. The positive estimates for FI (FI), actual human capital (H_CAP) and perceived human capital (P_CAP) remain statistically significant, supporting H1, H2a and H2b. These findings confirm that FI, formal education and perceived capabilities are drivers of entrepreneurial growth, including innovative entrepreneurial activities.

The interaction term between H_CAP and FI in Column (2) is statistically significant and negative (−0.149), suggesting that the positive effect of FI on entrepreneurial innovations

Table 3. PCSE regression results with innovative total early-stage entrepreneurial activity as the dependent variable

	Model specification (1)	Model specification (2)	Model specification (3)	Model specification (4)
L.FI	0.230*** (0.046)	0.761*** (0.059)	0.727*** (0.088)	0.751*** (0.070)
L.GDP	0.023 (0.018)	−0.064*** (0.018)	−0.026 (0.017)	−0.013 (0.037)
L.P_OP	0.262*** (0.021)	0.104*** (0.023)	0.119*** (0.027)	0.110*** (0.025)
L.FEAR_FAIL	0.463*** (0.031)	0.173*** (0.034)	0.188*** (0.035)	0.177*** (0.040)
L.Trade	0.051 (0.096)	0.036 (0.060)	0.023 (0.053)	0.043 (0.056)
L.H_CAP		0.683*** (0.081)		
L.FI#L.H_CAP		−0.149*** (0.014)		
L.P_CAP			0.522*** (0.058)	
L.FI#L.P_CAP			−0.132*** (0.024)	
L.HDI				2.586*** (0.573)
L.FI#L.HDI				−0.690*** (0.074)
Number of observations	239	216	239	239
Number of groups	40	36	40	40
χ^2	102,500	136,540	122,014	103,054

Notes: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. Standard errors in parentheses. The table also reports the χ^2 and the p -value of a modified Wald test for groupwise heteroscedasticity with the null hypothesis of homoscedasticity

Source: Authors' own work

decreases with higher levels of formal education. This finding still holds when H_CAP is replaced by the human development index (HDI) in Column (4). This result again confirms $H3$ stating that higher levels of formal education would decrease the (positive) effect of extended FI on entrepreneurial growth and innovations, aligning well with the earlier finding for TEA . This reinforces the view that extended FI for entrepreneurial growth and innovations would achieve less in populations with high levels of formal education, aligning with [Setyanti \(2021\)](#) and [Wang et al. \(2021\)](#), who demonstrate that formal education, often linked to increased risk aversion and reduced entrepreneurial intention, dampens the effect of financial resources on entrepreneurial activity.

Similarly, the estimate for the interaction between FI and P_CAP (self-perceived capabilities) is statistically significant and negative (-0.132), confirming our $H4$. The hubris theory is relevant to this decreasing effect of FI for entrepreneurial innovations. Taking it altogether, potential entrepreneurs, driven by self-confidence and commitment, often make business decisions, including the introduction of new products and services, even when the resources are limited ([Robinson and Marino, 2015](#); [Koellinger et al., 2007](#); [Hayward et al., 2006](#)). This growth tapers off as resources become more plentiful over time.

4.3 Robustness tests

We conducted a robustness test on the moderating effect of formal education (H_CAP) and self-perceived capabilities (P_CAP) using the GMM estimators. Specifically, we estimated GMM models on both TEA and $INNO$ as the dependent variables following [equations \(1\)–\(6\)](#), and compared the estimates for the interaction terms between FI and H_CAP and P_CAP with those presented in [Tables 2](#) and [3](#). The GMM models were estimated using a two-step system GMM procedure. The two-period lag of each dependent variable is included to account for the dynamics of entrepreneurial activities as the Arellano–Bond autocorrelation tests suggest no autocorrelation at the second order. Our GMM models satisfy the null hypothesis of no overidentification using the Sargan and Hansen-J tests. The results are presented in [Table 4](#).

Our GMM estimates in [Table 4](#) for most control variables (GDP , P_OP) are consistent with those presented in [Tables 2](#) and [3](#) in terms of statistical significance, sign and magnitude. The estimates for FI (FI), and two variables representing actual and perceived human capital (H_CAP , P_CAP) are also consistent, suggesting that these are drivers of entrepreneurial growth and innovations. The interaction terms between FI (FI) and formal education (H_CAP) and self-perceived capabilities (P_CAP) are statistically significant and negative, confirming the results from the PCSE estimates. Our findings for the nexus between FI, human capital and entrepreneurial growth are consistently robust, supporting the hypotheses developed from the existing literature.

5. Conclusions

This study explores how human capital influences the relationship between FI and entrepreneurship, using GEM data for a sample of 42 economies from 2006 to 2017. The study offers several unique features. First, FI is captured by a composite index encompassing accessibility, availability and usage of financial services. Second, the study examines both actual human capital, measured by formal education, and perceived human capital, measured by perceived self-capability for start-ups. Third, the study applies diverse theoretical arguments, from economics to risk aversion and entrepreneurship, to justify the human capital's role in the FI–entrepreneurship nexus. Our robust results provide *new* evidence of this moderating effect.

Table 4. Regression results using two-step system GMM estimators

	TEA as the dependent variable			INNO as the dependent variable				
	Model specification (1)	Model specification (2)	Model specification (3)	Model specification (4)	Model specification (5)	Model specification (6)	Model specification (7)	Model specification (8)
L2.Dependent variable	0.326** (0.145)	0.328*** (0.057)	0.240*** (0.075)	0.232*** (0.075)	0.585*** (0.163)	0.366*** (0.047)	0.365*** (0.059)	0.411*** (0.056)
L.FI	0.581** (0.279)	0.817*** (0.190)	1.274*** (0.352)	1.101*** (0.219)	0.349 (0.242)	0.928*** (0.080)	0.682*** (0.146)	0.748*** (0.067)
L.L.GDP	-0.265*** (0.094)	-0.310*** (0.058)	-0.364*** (0.068)	-0.459*** (0.132)	-0.078 (0.058)	-0.142*** (0.049)	-0.100*** (0.029)	-0.164*** (0.056)
L.L.P_OP	0.487*** (0.122)	0.404*** (0.062)	0.449*** (0.063)	0.403*** (0.055)	0.144** (0.060)	0.073*** (0.015)	0.063 (0.044)	0.006 (0.032)
L.L.FEAR_FAIL	-0.006 (0.306)	-0.179 (0.137)	-0.295* (0.157)	-0.277* (0.138)	0.109 (0.088)	-0.046 (0.052)	0.115 (0.076)	0.055 (0.054)
L.L.Trade	0.297 (0.209)	0.344*** (0.101)	0.388*** (0.105)	0.365*** (0.099)	-0.111 (0.203)	-0.031 (0.056)	-0.076 (0.053)	-0.081** (0.031)
L.H_CAP		0.448 (0.313)				0.494*** (0.082)		
L.FI#L.H_CAP		-0.085* (0.042)				-0.129*** (0.013)		
L.P_CAP			0.505*** (0.179)			0.508*** (0.065)		
L.FI#L.P_CAP			-0.157*** (0.076)			-0.128*** (0.031)		
L.HDI				4.600* (2.293)				3.483*** (0.885)
L.FI#L.HDI				-0.754*** (0.258)				-0.682*** (0.128)
N	291	256	291	291	239	216	239	239
AR(2) statistics	1.177	1.359	1.405	1.410	1.273	1.559	0.764	0.831
AR(2) <i>p</i> -value	0.239	0.174	0.160	0.158	0.203	0.119	0.445	0.406
Sargan statistics	17.663	19.423	17.504	18.824	27.852	31.217	27.690	25.173
Sargan's <i>p</i> -value	0.610	0.430	0.556	0.468	0.315	0.355	0.535	0.669
Hansen-J statistics	17.145	14.436	15.487	16.224	26.950	25.020	25.185	23.492
Hansen's <i>p</i> -value	0.644	0.758	0.691	0.642	0.358	0.677	0.669	0.754

Notes: ****p* < 0.01; ***p* < 0.05; **p* < 0.1. Standard errors in parentheses. AR(2) tests suggest that autocorrelation is not a major concern when using the second lag of the dependent variable. All the *p*-values for Sargan and Hansen-J tests suggest that overidentification is not an issue in our GMM approach

Source: Authors' own work

Notes: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. Standard errors in parentheses. AR(2) tests suggest that autocorrelation is not a major concern when using the second lag of the dependent variable. All the *p*-values for Sargan and Hansen-J tests suggest that overidentification is not an issue in our GMM approach

Source: Authors' own work

Findings show that a more inclusive financial system enables new venture creation. However, the extent of this positive effect depends on the level of human capital. Interestingly, countries with higher human capital exhibit less pronounced effects than those with lower human capital. This holds for both actual human capital – formal education and the human development index – and perceived human capital – self-perceived capabilities of potential entrepreneurs. The result is consistent across entrepreneurial outcomes using the TEA and innovative TEA rates. These findings support the risk aversion argument, which considers that higher formal education is associated with greater risk aversion (Jung, 2015) and higher expected returns on human capital investment (Becker, 1964). The finding for the moderating role of perceived capabilities further lends credence to the hubris theory of entrepreneurship, which associates excessive perception of self-capability with overconfidence, potentially impeding the effective use of financial support in entrepreneurial processes (Hayward et al., 2006).

The study's implications are significant. Both financial and human capital matter for new business formation worldwide. Our findings suggest that FI policies must account for the decreasing effect in response to high levels of human capital. Education strategies should focus on specific types of education, such as entrepreneurship education with financial literacy, rather than traditional academic curriculum, to foster entrepreneurship knowledge, skills and creativity. Likewise, entrepreneurship support schemes should aim to nurture and share appropriate levels of self-efficacy, avoiding excessively high self-efficacy, which is deleterious to the benefits of FI for entrepreneurial activities.

Despite offering novel insights and practical implications, our research has several limitations that warrant further investigation. First, as with most entrepreneurship studies using GEM data, we were constrained to examining interaction effects on entrepreneurial formation rather than entrepreneurial performance and success metrics, such as revenue growth, profitability or business sustainability. This limitation arises from the nature of the data available. Future research should strive to incorporate measures of entrepreneurial performance and success when analyzing the interplay between FI and human capital, as this would yield deeper insights into strategies for promoting entrepreneurship. Second, the literature suggests that the influence of human capital on the effects of FI may vary by entrepreneurship type – such as opportunity versus necessity, or formal versus informal. However, due to data constraints, this study did not explore these distinctions in relation to the moderating role of human capital. Finally, due to the aggregate nature of our data, we could not explore how FI and human capital influence men and women differently. Given the emphasis on gender equality in the United Nations' Sustainable Development Goal 5, future studies focusing on how expanded FI benefits women could provide critical guidance for more equitable financial support policies.

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Corresponding author

Thi Thu Tra Pham can be contacted at: tra.pham@rmit.edu.vn