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Entrepreneurship as a driver of economic development

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ABSTRACT

Objective: This study aims to analyse the relationship between entrepreneurship and economic development. Quantified through the gross domestic product (GDP) per capita, across selected developed and developing countries. The research seeks to clarify how variations in entrepreneurial activity, as measured by the Global Entrepreneurship Index (GEI), relate to GDP per capita, thereby contributing to the broader understanding of the economic impacts of entrepreneurship.

Research Design & Methods: This study adopted a quantitative approach, employing a cross-sectional ordinary least squares (OLS) model to explore the relationship between entrepreneurship and GDP per capita. Spanning the 2015-2019 period, our analysis incorporated data from 98 countries. Recognising the potential endogeneity concerns associated with specific independent variables, we implemented the instrumental variables (IV) approach, employing the two-stage least squares (2SLS) method to mitigate this potential bias.

Findings: Our findings suggest that differences in GDP per capita between countries are significantly associated with variations in entrepreneurship. This highlights the importance of entrepreneurship as a driving force for GDP per capita. According to the 2SLS model, we found a positive relationship between the global entrepreneurship index (GEI) and GDP per capita. On average, a one-percent increase in GEI is associated with a 3.04% increase in GDP per capita.

Implications & Recommendations: This study underscores the significant potential of entrepreneurship to drive economic development across diverse nations, regardless of their development stage. The findings demonstrate a positive and statistically significant association between higher levels of GEI and increased economic development. Therefore, policymakers have the potential to create an environment conducive to both entrepreneurship and sustainable economic development by implementing supportive policies and investing in key areas.

Contribution & Value Added: This study provides valuable insights into the relationship between entrepreneurship and economic development. It highlights the importance of creating an enabling environment supporting entrepreneurship through infrastructure, education, market development, and innovation investment. Further research is needed to explore the nuances of this relationship and develop effective policies to promote sustainable and competitive economic development.

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INTRODUCTION

Entrepreneurship is central to driving economic development across countries in today's dynamic global landscape. Economists have recently focused their research on identifying and understanding the key roles entrepreneurship plays in the economy (Acs, 2010; Sardana, 2016). The primary reason for investigating entrepreneurial activities is their potential to yield economic benefits for entrepreneurs and investors, contributing significantly to the overall economic prosperity of the nations in which they operate.

A vast body of economic literature has identified numerous factors that may influence GDP per capita, encompassing economic and non-economic determinants. These factors have been explored in theoretical (Porter & Stern, 2001; Shane, 2003) and empirical studies (Stel, 2006; Van Praag & Versloot, 2007; Block *et al*., 2016). Furthermore, numerous economists consistently acknowledge the significance of entrepreneurship in fostering economic growth (Brown & Ulijin, 2004; Vasconcelos & Oliveira, 2018; Galindo-Martin *et al*., 2020).

However, a significant research gap exists in comprehending the intricate relationship between entrepreneurship and its impact on GDP per capita. While several studies have attempted to explore how entrepreneurship affects countries' GDP per capita, a conspicuous scarcity persists in the economic literature. It is essential to clarify that entrepreneurship is the central phenomenon under study, while GDP per capita is used as a proxy to measure economic development. The confusion between phenomena and variables often arises because GDP per capita reflects the outcome of various economic activities, including those driven by entrepreneurship, rather than the entrepreneurial process itself. Not only is there a scarcity of understanding of the impact of entrepreneurship on economic development within specific country clusters, but also in a comparative context in both developed and developing countries. The existing limitation poses a significant challenge to achieving a comprehensive understanding required for guiding policymakers, entrepreneurs, and businesses. In turn, this hampers informed decision-making aimed at promoting entrepreneurial activities and fostering economic development. Thus, research that rigorously examines the efficacy of entrepreneurship on GDP per capita extends beyond individual countries or country groups, encompassing comparative analyses among developed and developing countries, fostering a more nuanced understanding of this intricate relationship.

This study addresses this gap and investigates how entrepreneurship affects GDP per capita in developed and developing nations on a global scale. Considering all the factors outlined above on entrepreneurship and GDP per capita across various country contexts, this article aims to empirically analyse entrepreneurship's impact (measured by the Global Entrepreneurship Index (GEI)) on GDP per capita in selected countries. Through an in-depth examination of these interconnections, we intend to provide valuable insights into the key drivers of economic development (expressed as GDP per capita) and offer recommendations that can be utilised by policymakers and entrepreneurs alike.

Our study presents a novel contribution by employing a specific combination of instruments to explore the relationship between entrepreneurship and GDP per capita. While similar variables have been employed in different economic contexts, no prior research has integrated this set of instruments to establish their statistical association with the GEI, measured in elasticities. By using elasticities, we provide more nuanced insights into the relative responsiveness of GDP per capita to changes in entrepreneurship, offering a more precise and policy-relevant interpretation.

The rest of the article is structured as follows. Section two will cover the literature review on entrepreneurship, innovation, and competitiveness within the context of entrepreneurship and economic development, with a focus on empirical studies. Section three will present the data sources, variables, and methods. Section four will address the key findings of our empirical research and discussion. Finally, section five will summarise our conclusion.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

In today's global economy, entrepreneurship is recognised as a crucial factor in boosting GDP per capita and driving overall economic advancement. Due to its significant economic impact, the intricate relationship between entrepreneurship and GDP per capita has long captivated scholars and policymakers. This literature review critically analyses extensive research on the symbiotic interplay between entrepreneurship and GDP per capita. By synthesising diverse perspectives and empirical findings, the review seeks to explain the mechanisms through which entrepreneurial activities contribute to economic advancement, exploring the multifaceted dimensions of this dynamic interplay.

The term 'entrepreneurship' traces back to 1766 when French economist Richard Cantillon coined it in his work 'Essay on the Nature of Trade in General' (Long, 1983). Cantillon associated entrepreneurship with trade to distinguish it from financial activities. He defined an entrepreneur as an individ-

ual undertaking all the risks of starting a business, making investments, covering expenditures, and anticipating returns (Van Praag, 1999).

Austrian economist Joseph Schumpeter (1883-1950) considered entrepreneurship a central element in the economic development mechanism (Śledzik, 2013). He emphasised the strong connection between innovation and entrepreneurship, asserting that the entrepreneur's special function is to utilise a new combination of production factors for innovation, forming the basis of economic development (Hagedoorn, 1996). Schumpeter identified five ways to drive economic advancement: creating new products, innovating production and sales, adopting new market strategies, finding new resources, and restructuring industries (Kotsemir & Abroskin, 2013).

Schumpeter believed that for entrepreneurs to make a profit, they need to be innovators. In his opinion, innovation was one of the main driving forces of competitiveness and economic development (Aiginger *et al.,* 2013; Śledzik, 2013; Malerba & McKelvey, 2020). According to Schumpeter, innovation is a 'process of industrial mutation that incessantly revolutionises the economic structure from within, incessantly destroying the old one, incessantly creating a new one' (Śledzik, 2013).

Noteworthy, there is a lack of proof based on empirical data. This fact results mainly from the difficulty in specifying the role of innovation and entrepreneurship and validating its measurement for empirical modelling.

Empirical studies reveal a significant relationship between entrepreneurship and GDP per capita and between entrepreneurship and innovation (Galindo & Méndez, 2014). Researchers established a positive correlation between entrepreneurial activity and innovation in developed countries (Block *et al*., 2016; Crudu, 2019; Loukil, 2019). They believe heightened entrepreneurial activity fosters innovation development (Van Stel *et al*., 2005; Crudu, 2019). Moreover, several empirical studies indicate that the role of entrepreneurship in the economy is rooted in the substantial job creation by small- and medium-sized enterprises, contributing positively to GDP per capita (Wong *et al*., 2005; Haltiwanger *et al*., 2013; OECD, 2017). However, some research suggests a negative impact of entrepreneurship on real GDP, GDP per capita, and overall economic development (Carree *et al*., 2007). Scholars offer diverse explanations for this negative impact, including risks posed by start-up entrepreneurs, the influence of uncertainty avoidance levels in countries, and methodological shortcomings in measuring the impact of new entrepreneurial start-ups (Wennekers *et al*., 2010; Cumming *et al*., 2014). Admittedly, many studies overlook innovation and confirm that entrepreneurial motivations vary across countries (Shane, 2009; Crudu, 2019). In developed countries, people pursue entrepreneurship for self-improvement, while in developing countries, it is often driven by necessity due to a lack of alternative employment opportunities. For most countries, fast-growing entrepreneurs are a key source of GDP formation, innovation and technology, productivity growth, and employment (Bygrave & Zacharakis, 2011; Reyes & Useche, 2019). Entrepreneurs are the leading force for economic and social progress (Broughel & Thierer, 2019). Moreover, the European Central Bank explains that innovation is one of the essential drivers of economic progress (European Central Bank, 2017; Pradhan *et al.,* 2017), and Porter and Stern (2001) state that 'Innovation – in the form of new products, processes, and ways of managing – is essential to economic development'.

Notably, in a modern economy, innovation's role is expanding daily (Courvisanos & Mackenzie, 2014). It provides entrepreneurs with the opportunity to attain a leading market position. Beyond enhancing company profits, innovation holds significance for the national economy (Maradana *et al*., 2017). Innovation has the potential to reshape enterprise structures and exerts a profound impact on competitiveness and economic development at both micro- and macro-economic levels (Ketels, 2006; Atkinson, 2013; Dedahanov *et al.*, 2017; Fyliuk *et al*., 2019).

Various studies highlight successful global entrepreneurship cases, reinforcing the strong connection between innovation and entrepreneurship, jointly influencing economic development (Wennekers *et al*., 2010; Brem, 2011; Stoica *et al*., 2020). However, opinions among researchers vary, suggesting that the impact of entrepreneurship and innovation, whether positive or negative, depends on a country's development level (Hong & Sullivan, 2013; Maradana *et al*., 2017; Almodóvar-González *et al*., 2020). In 1990, Porter asserted that 'today, innovation is the only way to maintain a competitive advantage,' although observational studies yield mixed results on the role of innovation and entrepre-

neurship in economic progress. Drucker (1998) later emphasised innovation as a crucial element in entrepreneurial activity, contending that innovative leaders motivate others to achieve their company's objectives and generate even more innovative solutions.

Practitioners interested in measuring the impact of entrepreneurship on economic development might face significant challenges, but proxies can provide insights. The global entrepreneurship index (GEI) from the World Bank is a widely used indicator for gauging entrepreneurial activity and innovation levels in a country's economy. However, as far as we know, no prior studies have definitively established a link between GEI and economic development. This research aims to address this gap by employing GDP per capita as a proxy for economic development across a diverse dataset of countries.

Therefore, to achieve our aim, we developed a hypothesis that will guide our future empirical examination based on those stated in the previous sections:

H0: Entrepreneurship positively and significantly impacts GDP per capita.

RESEARCH METHODOLOGY

As previously stated, in this study, we aimed to explore the relationship between entrepreneurship and GDP per capita, utilising data from the global entrepreneurship index (GEI) and the global competitiveness index (GCI) reports. We assessed 98 developed and developing countries (Appendix 1). We selected these 98 countries based on data availability for the variables pertinent to this study within the 2015-2019 World Economic Forum (WEF) reports (WEF, 2020). Moreover, we narrowed the selection to 98 countries due to consistent data availability across all variables used in our analysis, ensuring robustness and reliability in our findings.

We selected the GEI due to its comprehensive coverage of various aspects of entrepreneurial activity and its widespread use in academic research (GEDI, 2019; Kremer, 2019; Bonyadi & Sarreshtehdari, 2021; Inacio *et al*., 2021). It evaluates entrepreneurial processes across more than 130 countries annually, offering insights into individual country performance on national and global scales. Meanwhile, the GCI provides a valuable framework for assessing the broader entrepreneurial environment through its analysis of local populations' entrepreneurial beliefs, capabilities, and aspirations within existing socioeconomic structures. This is facilitated by evaluating 14 key 'pillars' of regional ecosystem stability. We utilised the 'Methodology and Computation of the Global Competitiveness Index 2017-2018' to ensure a standardised and comprehensive approach that aligns with our study period. This methodology facilitates consistent cross-country comparisons and helps to measure the economic conditions that influence competitiveness and economic development.

However, the primary focus of our study was not merely the descriptive aspects of GEI and GCI but instead – the causal relationship between entrepreneurship and GDP per capita. The core of our analysis involved testing this relationship using an instrumental variables (IV) approach, designed to address potential endogeneity concerns and confounding variables that may affect the estimation of this relationship.

Scholars widely recognize the dependent variable in our study, GDP per capita (constant 2010 USD), as a key indicator of economic development (Van Den Bergh, 2009; Cohen Kaminitz, 2023; Bazaluk *et al*., 2024). While GDP per capita reflects the overall economic performance of a country, it is essential to emphasise that it does not directly measure entrepreneurial activity or innovation. Instead, GDP per capita is a proxy for the economic outcomes to which entrepreneurial activities contribute. The distinction lies in that GDP per capita captures the results of various economic processes, including those driven by entrepreneurship, rather than the entrepreneurial processes themselves.

The independent variables in our study, except for the GEI, include measures that capture various critical dimensions of a country's economic environment: infrastructure, health, primary education, higher education and training, market size, business sophistication, and innovation. We selected these indicators, sourced from the 'Methodology and Computation of the Global Competitiveness Index 2017-2018,' for their relevance in measuring the economic conditions that influence competitiveness. Although these variables are not components of the GEI, they are essential in explaining the broader

economic context in which entrepreneurship operates. The GEI, which serves as a central variable in our analysis, evaluates the health and quality of entrepreneurship ecosystems across different countries. Moreover, while 'Infrastructure,' 'Health and Primary Education,' 'Higher Education and Training,' and 'Business Sophistication' are indeed broad economic phenomena, in our study, they were rigorously operationalised into specific, quantifiable variables. This operationalisation, supported by a well-established methodology and empirical validation, ensured that these phenomena were accurately and reliably represented in our analysis, allowing for robust and meaningful conclusions about their impact on economic performance.

In Table 1 we explain the dependent and independent variables used in this research and their definitions.

Table 1. Description of the variables considered in the analysis

Variables	Definition Dependent Variable	Source
GDP per capita (2015-2019)	GDP per capita is a fundamental economic indicator that measures the average income or standard of living of a country's population. It is calculated by dividing a nation's gross domestic product (GDP) by its total population.	World Economic Forum; Foundations of descriptive and inferential statistics 2019; World Bank (WDI)
Independent Variables		
Global entrepreneurship index (GEI)	A composite index measuring entrepreneurial attitudes, abilities, and aspirations at the country level.	The Global Entrepreneurship and Development Institute (GEDI Institute)
Infrastructure	This variable assesses the quality of a country's infrastructure, including transportation, communication, energy, and public services, which are essential for economic functioning.	Methodology and Computation of the Global Competitiveness Index 2017-2018
Health and primary education	These variables measure the effectiveness of a country's health system and primary education. It includes population health indicators, the quality of primary education, and access to these services.	Methodology and Computation of the Global Competitiveness Index 2017-2018
Higher education and training	Higher education and training evaluate the quality and accessibility of tertiary education and workforce training, considering factors such as the relevance of education to workforce needs and the extent of staff training.	Methodology and Computation of the Global Competitiveness Index 2017-2018
Market size	Market size assesses the potential domestic demand within a country, considering factors like population size and purchasing power.	Methodology and Computation of the Global Competitiveness Index 2017-2018
Business sophistication	Business sophistication evaluates the innovation, efficiency, and technological readiness of a country's business sector, including the use of technology and market efficiency.	Methodology and Computation of the Global Competitiveness Index 2017-2018
Innovation	Innovation measures a country's capacity to generate new ideas, technologies, and products that contribute to economic development.	Methodology and Computation of the Global Competitiveness Index 2017-2018

Source: own study.

While the GEI and GCI indicators focus on different aspects of economic performance – GEI on entrepreneurial attitudes, abilities, and aspirations, and GCI on macroeconomic conditions that influence these entrepreneurial capacities – there is a potential for conceptual overlap. However, in our methodology, it is crucial to acknowledge the absence of overlap between selected variables within the panel dataset.

This non-overlapping nature arises from various factors, including changes in data collection methodologies and variations in variable definitions, temporal dynamics, the dynamic economic context, and potential policy and regulatory shifts. To navigate these complexities, we conduct a detailed examination of each variable for each year. This tailored analysis captures each variable's unique characteristics and contextual influences over time. Furthermore, we conduct robustness checks to ensure the accuracy of our methodology, even when dealing with non-overlapping variables.

Therefore, to ensure that our analysis does not suffer from this overlap and to test our hypothesis, we employed a rigorous methodology beginning with a correlation analysis to explore the associations between the dependent and independent variables. Following this, we conducted an extensive analysis using cross-sectional linear regression models. To ensure an accurate estimation of regression coefficients, we applied the ordinary least squares (OLS) method (Oksanen, 1991). This approach was designed to thoroughly investigate the complex relationship between entrepreneurship and GDP per capita across diverse economic contexts, encompassing developed and developing countries.

For the cross-sectional analysis, we utilised a log-log OLS regression model to estimate the relationship between the independent variables and GDP per capita for each year within our study period. This model included 98 observations for each year, corresponding to the 98 countries in our sample. The log-log specification allowed us to interpret the estimated regression coefficients as elasticities. Below, we present the general equation for the fixed effects (FE) or random effects (RE) model:

$$lny_i = \beta_0 + \sum_{i=1}^{n} \beta_i lnx_i + \sum_{j=1}^{m} \gamma_j + \varepsilon_i \quad (1)$$

In equation (1), y_i – represents dependent variable (GDP per capita); x_i – independent variables; γ_j – entities fixed or random effects; n – number of independent variables; m – number of entities (countries); β_0, β_i – regression coefficients; ε_i – error term.

We recognised the importance of considering all relevant instrumental variables that could impact the GEI. To this end, we conducted a comprehensive multicollinearity test on the independent variables (Appendix 3). The results revealed significant multicollinearity, posing the risk of biased and inefficient estimates in an OLS framework. Specifically, the high variance inflation factors (VIFs) showed that all variables, except GEI, exhibited very high VIFs and correspondingly low tolerance values. This finding made it necessary to adopt an alternative method. Consequently, we chose the two-stage least squares (2SLS) approach (Greene, 2008), as it effectively addresses both multicollinearity and potential endogeneity issues.

Furthermore, recognising the potential for endogeneity or measurement errors — mainly since most of the independent variables, aside from GEI, are based on subjective survey data from business executives—we opted for the IV approach. We chose the instruments based on their established relevance in previous studies and their theoretical significance in explaining GEI. An essential contribution of this analysis lies in the IV approach used to address endogeneity concerns. Specifically, we employed external instruments that are both theoretically and empirically grounded, ensuring they meet the relevance and exclusion restriction criteria. We selected these instruments because they strongly correlate with the endogenous regressors but are uncorrelated with the error term in the outcome equation, providing a credible identification strategy.

Therefore, as the first step in the 2SLS method, we regressed GEI on four instrumental variables: infrastructure, health and primary education, higher education and training, and market size, all in log-log form. Innovation and business sophistication variables were excluded due to their lack of statistical significance. In contrast, the selected instruments produced highly significant p-values, confirming a strong correlation with GEI. However, after further analysis, we found that excluding the higher education and training variable improved the Sargan over-identification test results. Based on this finding, we decided to omit higher education and training from the final list of instruments. This adjustment enhances the accuracy and reliability of our model, ensuring that the remaining instruments provide a stronger and more focused explanation of the relationship between GEI and economic outcomes.

Our approach offers a novel contribution by combining these specific instruments in the context of entrepreneurship and GDP per capita. While prior studies have used similar variables in different economic contexts, our research uniquely integrates these specific instruments and establishes their statistical association with the GEI. We have thoroughly tested each instrument to demonstrate its link to the GEI, setting our study apart from others.

The unique combination of these instruments within a panel IV 2SLS framework allowed us to control for endogeneity while addressing both country-specific and time-specific effects. This approach has not been explored in previous literature, adding significant value to our analysis. By applying this particular set of variables, which has never been tested together, we offer new insights into

the relationship between entrepreneurship and GDP per capita across 98 countries, enhancing the robustness and depth of our findings.

Moreover, we provide a more focused and statistically robust model that avoids potential over-identification by excluding innovation and business sophistication from the instrument set due to their lack of statistical significance in the first stage. This refined selection contributes to the novelty of our approach and offers a clearer understanding of the specific channels through which entrepreneurship affects economic growth.

Furthermore, we enhanced the analysis by employing a panel data approach, with 490 observations across 98 countries over five years. The panel specification allowed us to control for both time and country-specific effects, addressing unobserved heterogeneity and improving the robustness of the results.

$$lnx_1 = \theta_0 + \sum_{j=1}^{n} \theta_j lnz_j + \nu_i \quad (2)$$

$$lny_i = \beta_0 + \beta_1 \widehat{x_1} + \varepsilon_i \quad (3)$$

In equation (2), z_j – represents instrumental variables (infrastructure, health and primary education, and market size); θ_j – regression coefficients; ν_i – error term. We believe that these instruments, backed by theoretical justification, contribute to the novelty of instrumentalisation, offering a more reliable approach to addressing potential biases arising from omitted variables and measurement errors.

Equation (3) contains fitted values of the dependent variable from equation (2). In this model specification, independent variables from the study dataset can serve as instruments. The estimated value of the coefficient $\beta 1$ serves to test the hypothesis.

Additionally, we validated the selected instruments through rigorous tests, including the Hausman, Sargan, and weak instruments tests. We used the Hausman test (Hausman, 1978) to determine whether the OLS or IV estimator provided more efficient and consistent results. The Sargan over-identification test evaluated whether the number of instruments was excessive. Furthermore, the weak instruments test determined whether the instruments were sufficiently strong. These tests were also valuable in identifying which variables should be used as regressors (in equation (3)) in the model and which should serve as instruments (regressors in equation (2)).

While we acknowledge that the IV strategy has limitations, including potential concerns regarding unobserved confounding factors, we have carefully considered threats to the exclusion restriction. The combination of theoretical justification, empirical testing, and robustness checks, such as the Hausman test, Sargan test, and weak instruments test, demonstrates that the chosen instruments provide a reasonable approach to addressing potential endogeneity concerns.

Although there is always a risk of unobserved confounding factors, our approach is reasonable given the available data and theoretical considerations. Future research might explore alternative instruments or methods to further strengthen the identification strategy.

RESULTS AND DISCUSSION

As delineated in the methodology section, we analysed 98 countries, comprising both developed and developing countries, across the timeframe spanning from 2015 to 2019. Consequently, the ensuing models present the outcomes observed across this comprehensive cohort of 98 countries.

The correlation matrix (Appendix 2) revealed notable relationships among different variables, shedding light on their interconnectedness and potential influence on GDP per capita and entrepreneurial indices.

Specifically, we found a strong positive correlation between GDP per capita and GEI. This correlation suggests that higher entrepreneurial activity, as the GEI indicates, tends to be associated with increased GDP per capita. It implies that a conducive environment for entrepreneurship may contribute positively to a country's economic wealth.

Infrastructure indicators and various educational components (Health and Primary Education, High Education and Trainings) exhibited strong positive correlations. This suggests their interde-

pendency and underscores the importance of robust infrastructure and a well-educated workforce in fostering economic development and entrepreneurship.

Along with Innovation, Market Size and Business Sophistication demonstrate strong correlations. This indicates that larger markets, sophisticated business environments, and innovative capacities tend to coincide. These factors are essential for supporting entrepreneurial activities, fostering competitiveness, and positively influencing economic development.

The moderate to strong positive correlations observed among different variables accentuate the multifaceted nature of economic development and entrepreneurship. They highlight how various elements intertwine and potentially impact a country's economic prosperity, from infrastructure to education, market dynamics, and innovation.

Understanding the correlations between these variables offers valuable insights for policymakers and stakeholders. It underscores the importance of creating an enabling environment that supports entrepreneurship through investment in infrastructure, education, innovation, and market development. Enhancing these aspects collectively may contribute to fostering economic development and entrepreneurial activities.

In conclusion, the correlation matrix illuminates the intricate relationships between different factors and their potential implications for economic development and entrepreneurship. It suggests that a holistic approach, addressing various interconnected aspects, may be crucial in fostering a conducive environment for entrepreneurial and sustainable economic development.

Before conducting further analysis and putting our models through their tests, we had to acknowledge that the GEI index exhibits characteristics related to individual and institutional factors in product or process innovation (GEDI, 2019; Szerb *et al*., 2018; Kremer, 2019). Therefore, we decided to omit the independent variable Innovation to avoid inaccuracies in our calculations and analyse the findings of our models afterwards.

The cross-sectional model estimation for our variables is shown in Model 1 for each year (Table 2). We estimated Model 1 in log-log form, in which the interpretation of coefficient estimates was elasticities. As we see for all counties included in the analysis, various independent variables can significantly impact GDP per capita: GEI and infrastructure, as well as market size, are all significant variables to consider. However, for the entire period, health and primary education and higher education and training were determined to be statistically insignificant. This could be because each country had its combination of characteristics. As a result, these variables did not apply to all countries.

Following the constant, the dynamic of the coefficient changed over time. It was statistically significant for the entire period. On the other hand, the coefficient has experienced a slight decrease since 2017.

Estimates for the GEI independent variable demonstrated a positive and highly significant influence on GDP per capita (constant 2010 USD) at the level of the entire sample of countries for each year. This discovery was similar to other scholars (Aparicio, 2017; Guerrero *et al*., 2020). Since 2016, there has been a declining trend in the ratio, which reached 0.260 in 2017. The coefficient began to increase in 2018, and in 2019 it reached 1.095. We believe that the impact of entrepreneurial activities on economic development does not occur suddenly but instead develops over time. As a result, we conclude that long-term entrepreneurship strategies are necessary since the influence of entrepreneurship on economic development changes over time.

The coefficient for infrastructure fluctuates over time. From 2015 to 2017, the coefficient was positive and statistically significant. Even though the coefficient decreased throughout 2018, eventually falling to 0.509, it remained statistically significant. Coefficients were negative and statistically insignificant in 2019. These findings demonstrate that infrastructure investments, particularly those made during the early stages of development, can considerably contribute to economic development.

In recent years, particularly in 2015, 2016, and 2017, the health and primary education coefficient was negative and statistically insignificant. However, starting in 2018, the ratio began to rise. By contrast, when comparing 2018 to 2019, the ratio rose by 67%. Based on recent findings, we may conclude that our independent variable is becoming an important driver of GDP per capita for each country.

In the case of higher education and training, the results show that the ratio varies from year to year. Furthermore, in 2019, the coefficient reached 0.644, which was the highest value in the entire

period. We may explain such results by the fact that interest in this field is growing among the countries, and they expect a higher impact on GDP per capita. As a result, countries are increasing their investments in higher education and training.

Table 2. Cross-sectional model (OLS) coefficient estimations, dependent variable: GDP per capita

Variables	2015	2016	2017	2018	2019
const					
Coefficient	5.67732	6.40475	7.71894	6.07401	6.55182
p-value	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***
GEI					
Coefficient	0.863549	0.862178	0.259984	0.821288	1.0954
p-value	0.0012***	0.0006***	0.0827*	0.0003***	<0.0001***
Infrastructure					
Coefficient	0.917319	0.69329	0.87359	-0.500908	-0.165489
p-value	0.0397**	<0.0001***	0.0469**	0.0018***	0.3832
Health and primary education					
Coefficient	-0.468438	-0.599172	-0.316416	0.190103	0.234469
p-value	0.3751	0.1864	0.5545	0.7081	0.465
Higher education and training					
Coefficient	0.410751	0.390164	0.487401	0.424038	0.644244
p-value	0.4266	0.3995	0.367	0.4238	0.118
Market size					
Coefficient	0.19943	0.153022	0.116835	0.264169	0.333875
p-value	0.3049	0.3712	0.5522	0.1613	0.0515*
Business sophistication					
Coefficient	-0.172075	-0.147765	0.0106365	0.396757	-1.28814
p-value	0.7801	0.7697	0.9868	0.5021	0.0125**
Observation	98	98	98	98	98
R-squared	0.922292	0.941605	0.917923	0.932145	0.930498
F (10, 87)	103.2579	140.2863	97.29865	119.5152	116.476
Adjusted R-squared	0.91336	0.934893	0.908489	0.924346	0.922509
P-value (F)	7.38E-44	3.20E-49	7.83E-43	2.11E-46	5.96E-46

Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: GEI Report 2015-2019; GCI Report 2015-2019; World Bank 2015-2019. Own elaboration based on calculations in R-studio.

Except for 2019, market size has never had a statistically significant impact on GDP per capita. However, during the specified period, the ratio was positive. In comparison to 2018, the ratio increased by 26% in 2019. As a result, we predict that broadening the market size field will significantly affect the rising GDP per capita in the selected countries

According to business sophistication, the coefficient's dynamic was unstable and changed over time. The tendency for coefficients to grow began in 2017. However, the ratio fell rapidly in 2019, eventually becoming negative and statistically significant. We believe that further investment in this field will lead selected countries towards economic progress.

The need for countries to stimulate various disciplines, including health and primary education, higher education, and training, as well as market size and business sophistication, could be a probable explanation for these findings. Furthermore, it appears that if these countries had initially increased their investments in these sectors, they would have significantly contributed to faster GDP per capita outcomes. In both the short and long run, investments can significantly impact the GDP per capita.

Table 6 presents the multicollinearity statistics for the variables used in our analysis. The multicollinearity analysis reveals significant concerns, particularly for Infrastructure, Health and Primary Education, Higher Education and Training, and Business Sophistication, which exhibited very high VIFs and low tolerance values. These findings indicate substantial overlap among these predictors, which could potentially

bias the coefficient estimates and inflate standard errors. In light of these results, careful consideration was given to selecting instruments and variable inclusion to ensure robust and reliable model estimates.

Further, Hausman test results revealed a significant difference between OLS estimates and the consistent estimates from the 2SLS approach, highlighting concerns about potential endogeneity in the model. This suggests that the entrepreneurship variable, as measured by GEI, may be influenced by GDP per capita, potentially distorting the true relationship between these variables. Although the residuals from the regression did not meet the normality assumption – likely due to the relatively small sample size of countries – the coefficients remained statistically significant, and the adjusted R-squared values were satisfactory. The Hausman test's low p-value indicated that OLS estimation was inconsistent, leading us to favour the 2SLS approach.

In response to these concerns, we adopted the IV approach using 2SLS, which allowed us to address endogeneity effectively. The four instruments – infrastructure, health and primary education, higher education and training, and market size – were validated based on their strong correlation with GEI. As mentioned in the methodology section, innovation and business sophistication were deemed statistically insignificant and excluded from the analysis. We chose these instruments to ensure consistency and reliability in addressing endogeneity and provide a credible identification strategy. The 2SLS methodology proved superior to OLS, offering a more robust explanatory framework and improving the model's ability to capture the nuanced relationship between GEI and GDP per capita. Given the multicollinearity issues identified in our preliminary analysis, we deliberately avoided including control variables in the second stage to prevent exacerbating multicollinearity and compromising the reliability of our estimates.

To clarify, our primary goal with the 2SLS approach was to address endogeneity concerns and improve the robustness of our estimates. In the first stage, we regressed the GEI on the selected instrumental variables to obtain the predicted values of GEI, which we then used in the second stage. This approach intended to isolate the variation in GEI exogenous to the outcome equation.

Incorporating control variables in the second stage could provide an additional robustness check. However, introducing additional regressors might result in the risk of spurious regression and would only be justified if there is a significant concern regarding omitted variable bias. Since the GEI has shown a statistically significant link to the dependent variable, and the regression errors follow a normal distribution, reducing the risk of omitted variables, we have opted to include only the GEI as the regressor in the second stage. At the same time, testing the inclusion of further regressors may be conducted in future research. This would be especially important in identifying potential ways in which changes in GEI impact GDP per capita.

While the Sargan test raised some concerns about the validity of all instruments, the high F-statistic indicated that the instruments used in the model possessed sufficient explanatory power. This effectively mitigated concerns about instrument weakness. However, excluding the variable for higher education and training significantly improved the results of the Sargan over-identification test. Therefore, we decided to exclude this variable from the list of instruments in the final model. This indicates that higher education was less associated with the GEI than other instruments. In other words, this suggests that health and primary education, infrastructure, and market size have a more significant link to the GEI and, by extension, to GDP per capita than higher education and training. It is also possible that these three instruments serve as prerequisites, while higher education only impacts the GEI in their presence. These aspects present interesting opportunities for further research. Especially, this finding is relevant for the research focusing on potential paths in which indicators of entrepreneurial activity impact economic development.

As a result of this shift towards the IV 2SLS methodology, our analysis gained robustness, leading to a more convincing and academically grounded examination of the intricate relationship between entrepreneurship and GDP per capita. The outcomes from (Table 3) further strengthened our confidence in the assertion that the IV 2SLS approach offers a more comprehensive and reliable means of unravelling the nuanced dynamics between these pivotal economic determinants.

According to Model 2, there was a positive link between GEI and GDP per capita (constant 2010 USD) at the 95% alpha level. The coefficient equals approximately 3 (which means a 3% increase in GDP per capita when GEI increases by 1%). This model was estimated for all the selected countries.

After conducting multiple analyses for selected countries and using all other variables instead of GEI as an independent variable, we concluded that GDP per capita has a statistically significant relationship with GEI. In contrast, it does not exhibit such a relationship with any of the other examined variables. Models with other independent variables from the dataset (infrastructure, health and primary education, higher education and training, market size, and business sophistication) showed a significantly low level of R-squared and were excluded from the analysis. The fact that the effect of all other variables is already captured in GEI effectively explains our findings.

Table 3. IV 2SLS model for the dependent variable GDP per capita (constant 2010 USD) (between estima-tor)

TSLS, using 490 observations Dependent variable: log of GDP per capita, in constant 2010 USD				
Statisics	**Coefficient**	**Std. error**	**t-ratio**	**p-value**
const	-1.62680	0.331827	-4.903	<0.0001***
l_GEI	3.04050	0.0934421	32.54	<0.0001***
Mean dependent var	9.110937		S.D. dependent var	1.484236
Sum squared resid	289.5884		S.E. of regression	0.770337
R-squared	0.775729		Adjusted R-squared	0.775270
Chi-square (1)	1058.781		p-value	<0.0001***
Instruments	Infrastructure, health and primary education, and market size			
Hausman test				
Null hypothesis: OLS estimates are consistent				
Asymptotic test statistic: Chi-square (1) = 115.164, with p-value = <0.0001***				
Sargan over-identification test				
Null hypothesis: all instruments are valid				
Test statistic: LM = 1.68842 with p-value = P (Chi-square (3)> 1.68842) = 0.429897				
Weak instrument test – First-stage F-statistic (3, 486) = 155.189				

Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: GEI Report 2015-2019; GCI Report 2015-2019; World Bank 2015-2019. Own calculations in R-studio.

As part of our robustness checks, we tested the addition of control variables for the countries, which demonstrated the highest errors after model fitting (Slovakia, India, and Hong Kong) and the baseline model (Table 3). As a result, the coefficient for GEI decreased to 2.47% (p-value < 0.0001). The direction of the effect stayed the same as in the baseline model but the coefficients for control variables were not statistically significant. These findings confirm the outcomes of the baseline model while adding control variables with statistically insignificant coefficients. As a result, we chose the baseline model as the main one.

Overall, the IV 2SLS model results effectively showed that countries with higher levels of GEI tend to achieve higher levels of GDP per capita. Noteworthy, this finding has been proved for the pooled dataset of countries, including developed and developing countries. Using the pooled datas*et* allows the model to capture the variance between countries, and therefore, the estimated values of the regression coefficient reflect the average effect of GEI improvement on GDP per capita growth. In contrast to previous studies (Hong & Sullivan, 2013; Maradana *et al*., 2017), we showed the average association between GEI and GDP per capita. At the same time, the literature already confirmed the association between entrepreneurship and economic development (Aparicio, 2017; Doran *et al*., 2018; Guerrero *et al.*, 2020). The current study confirmed the previous findings of other authors by using GEI as a proxy measure of entrepreneurship activity. Nevertheless, correlation and association do not mean causality. Therefore, the direction of the influence required further investigation.

Drawing on the results, it is evident that fostering entrepreneurial activities can yield a positive and substantial influence on economic development, as measured by GDP per capita. Moreover, such activities can be a crucial foundation for a country's innovativeness and competitiveness. An alternative interpretation of these outcomes aligns with hypotheses posited by other scholars (Naudé *et al*., 2011; Feki & Mnif, 2016; Farinha *et al*., 2018).

CONCLUSIONS

The study investigated the relationship between entrepreneurship, as measured by the GEI and GDP per capita across 98 countries from 2015 to 2019. We aimed to assess whether entrepreneurship positively and significantly impacts economic development in developed and developing economies.

The analysis revealed that our hypothesis was corroborated. A significant positive relationship exists between entrepreneurship and GDP per capita in developed and developing countries. Specifically, on average, a 1% increase in the global entrepreneurship index (GEI) is associated with a 3.04% rise in GDP per capita, indicating that countries with higher GEI rankings tend to exhibit higher GDP per capita figures.

Furthermore, this study offers several notable features. Firstly, it captures entrepreneurship's influence on economic development across various economies, which could provide insights into developed and developing countries. Secondly, it highlights the importance of key variables such as health and primary education, higher education and training, business sophistication, and market size, which may be critical in supporting entrepreneurial activities and fostering long-term economic development. Lastly, it integrates short-term and long-term perspectives, which might enable policymakers to anticipate the varying effects on GDP per capita and shape their strategies accordingly.

Interestingly, while some variables may negatively impact entrepreneurship and GDP per capita in the short term, our findings suggest they contribute positively to long-term economic development. For policymakers, this study emphasises the importance of fostering entrepreneurship alongside other essential sectors like health and education to stimulate innovation, job creation, and improved quality of life. Policymakers can leverage these insights to shape policies that balance immediate economic needs with long-term development goals.

While this study provides valuable insights into the relationship between GEI and GDP per capita, it is essential to acknowledge the limitations of our research, including a small sample size (98 countries) and a short study duration (2015-2019). Moreover, our study observed an association, rather than causality, between the entrepreneurship environment (using GEI as a proxy) and economic development (expressed as GDP per capita). Further research could broaden the study's scope by including a broader range of nations and employing diverse methodologies. This would allow for a deeper investigation into potential additional factors influencing both the dependent (GDP per capita) and independent (GEI) variables, ultimately providing a more nuanced understanding of the causal relationship between entrepreneurship and economic development.

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Appendix 1: Selected developed and developing countries

Albania	El Salvador	Latvia	Romania
Algeria	Estonia	Lithuania	Russian Federation
Argentina	Ethiopia	Luxembourg	Saudi Arabia
Australia	Finland	Madagascar	Serbia
Austria	France	Malawi	Singapore
Bahrain	Gambia, the	Malaysia	Slovak Republic
Bangladesh	Germany	Mali	Slovenia
Belgium	Ghana	Mauritania	South Africa
Botswana	Greece	Mexico	Spain
Brazil	Guatemala	Montenegro	Sri Lanka
Bulgaria	Honduras	Morocco	Sweden
Burundi	Hong Kong SAR	Mozambique	Switzerland
Cambodia	Hungary	Namibia	Tanzania
Cameroon	Iceland	Netherlands, the	Thailand
Canada	India	Nigeria	Trinidad and Tobago
Chad	Indonesia	Norway	Turkey
Chile	Ireland	Oman	Uganda
China	Israel	Pakistan	Ukraine
Colombia	Italy	Panama	United Arab Emirates
Costa Rica	Japan	Paraguay	United Kingdom
Croatia	Jordan	Peru	United States
Cyprus	Kazakhstan	Philippines	Vietnam
Czech Republic	Kenya	Poland	Zambia
Denmark	Korea, Republic of	Portugal	
Egypt	Kuwait	Qatar	

Source: The Global Competitiveness Report 2017-2018.

Appendix 2: Correlation results for the year 2015-2019

Variables	GDP Per capita	GEI	Infrastructure	Health and Primary Education	High education and trainings	Market Size	Business Sophistication	Innovation
GDP Per capita	1	0.809***	0.068	0.059	0.078	0.035	0.06	0.116
GEI	0.809 ***	1	0.061	0.046	0.073	0.031	0.05	0.123
Infrastructure	0.068	0.061	1	0.978***	0.979***	0.954***	0.975***	0.954***
Health and Primary Education	0.059	0.046	0.978***	1	0.987***	0.949***	0.982***	0.953***
High education and trainings	0.078	0.073	0.979***	0.987***	1	0.948***	0.989***	0.968***
Market Size	0.035	0.031	0.954***	0.949***	0.948***	1	0.962***	0.940***
Business Sophistication	0.06	0.05	0.975***	0.982***	0.989***	0.962***	1	0.962***
Innovation	0.116	0.123	0.954***	0.953***	0.968***	0.940***	0.962***	1

Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: GEI Report 2015-2019; GCI Report 2015-2019; World Bank 2015-2019; own elaboration based on calculations in R-studio.

Appendix 3: Multicollinearity statistics

Statistics	GEI	Infrastructure	Health and Primary Education	High education and training	Market Size	Business Sophistication	Innovation
Tolerance	0.896	0.032	0.020	0.011	0.059	0.016	0.052
VIF	1.115	31.737	49.905	94.189	16.963	64.286	19.199

Source: own elaboration based on calculations in R-studio.

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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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