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Innovation, Entrepreneurship, and Economic Growth: The Moderating Role of Corruption

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ABSTRACT. This study examines the relationships among a nation's innovation capability, entrepreneurship, and economic growth and investigates the corruption level's impact on those relationships. Based on 2022 data of 44 counties from the Global Innovation Index (GII), Gross domestic product (GDP), Total early-stage entrepreneurial activity (TEA), and the Corruption Perceptions Index (CPI), obtained from the World Intellectual Property Organization, World Bank, Global Entrepreneurship Monitor, and Transparency International, a multiple regression analysis was used to examine the causal relationship between innovation capability, entrepreneurial climate, and economic growth. The results showed that a nation's innovation capacity significantly positively affects the growth of economies. On the one hand, the result found that entrepreneurship is negatively associated with economic growth. This can imply that a significant portion of entrepreneurship in the analyzed countries may be necessity-driven rather than opportunity-driven. Additionally, the study found that corruption moderates the relationship between a nation's innovation capacity and economic growth, such that higher levels of corruption weaken the positive impact of innovation capacity toward economic growth but are not found to significantly moderate the relationship between entrepreneurship and the growth of nation economies. These findings emphasize the significance of addressing corruption to exploit the advantages of innovation capacity for economic growth. Policymakers should focus on improving the entrepreneurial ecosystem to promote opportunity-driven ventures that foster innovation and contribute to long-term economic development. This work is among the few to discover nationally the compound interplay between innovation, entrepreneurship, and corruption. It offers useful insights for policymakers who seek to promote economic growth by improving governance and creating a favorable climate for entrepreneurs.

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1. Introduction

Innovation and entrepreneurship have gained attention as critical drivers for prospering economies of nations. As the global economy becomes increasingly competitive, nations face the challenges of developing and sustaining their economic growth. Innovation has been realized as one of the critical agendas for governments worldwide to drive both nations' competitive advantage and sustainable economic development [1-3]. Innovation refers to generating and exploiting new ideas, technologies, or processes vital for value creation and long-term sustainability growth [4]. On the one hand, Entrepreneurship plays a critical role in converting these innovations into products and services, which promotes economic growth and job creation [2, 5]. Previous research has confirmed the relationship between innovation, entrepreneurship, and economic development [4, 6]. Nations' economies are driven by innovation, where entrepreneurship is vital in bridging new ideas to the market [6]. This dynamic interaction between innovation and entrepreneurship is essential for promoting economic growth and development. In addition, innovation and entrepreneurship are important drivers of economic growth [4]. The study highlights the significance of developing an institutional and policy environment that supports innovation and entrepreneurship to harness their potential for fostering economic development.

While nations' innovation capability and entrepreneurial climate are crucial to economic growth, institutional issues, specifically corruption, can diminish these impacts. Corruption refers to the misuse of authority for personal benefit and is a danger to economic growth because it skews market dynamics, misallocates resources, and produces inefficiencies [7-8]. Corruption weakens the efficiency of policies designed to enhance innovation and entrepreneurship by increasing business costs and lowering the incentives for investment and innovation [9]. Entrepreneurs may encounter additional difficulties in nations with high levels of corruption, such as unfair competition, bureaucratic red tape, and rent-seeking practices that can hinder innovation and growth prospects. In addition, rent-seeking conduct becomes conventional when there is environmental corruption. Businesses are more likely to focus on short-term gains by manipulating the system for personal advantage and exploiting government connections rather than focusing on long-term benefits and creating sustainable value via innovation. Instead of creating value through innovative products and services, businesses may prioritize short-term gains by exploiting government connections or manipulating the system for personal advantage.

This diminishes healthy competition and discourages new market entrants, stifling entrepreneurial growth and limiting the overall potential for economic development [10]. Similarly, the negative consequences of corruption on investment rates assert that corruption incurs institutional ineffectiveness and discourages private sector investments [8].

Although prior studies tried to explore the dynamic effect of innovation and entrepreneurship on the economic development of nations [4, 6], the research remains limited in numerous key areas. Institutional elements like corruption play a crucial role in impeding the impact of innovation capabilities and the entrepreneurial climate on the economic development of nations. Therefore, there is a demand for empirical research to understand better how corruption distorts the influences of innovation and entrepreneurship on national growth. This study aims to comprehensively understand relationships among innovation, entrepreneurship, corruption, and economic development. This research seeks to fill the existing gaps in the literature and offer valuable insights for policymakers to promote sustainable economic growth. The rest of the article is structured as follows: The second section presents a literature review on national innovation capabilities, entrepreneurship, corruption, and their linkages to economic growth. The third section explains the study's research methodology. The fourth section provides the data analysis detail and proposed hypothesis testing. The fifth section pertains to a discussion of the findings. The conclusion limitation and future research suggestions are described in the sixth section.

2. Literature Review

2.1 Innovation, Entrepreneurship and Economic Development

The concept of a nation's innovation capability has gained attention from government and policymakers as one of the vital mechanisms to create a nation’s competitive advantage and achieve sustainable long-term economic growth. Nation innovation capabilities refer to the capacity of a country to develop, accept, and disseminate new concepts, ideas, and procedures necessary to improve competitiveness, productivity, and general economic prosperity [11]. National innovation capability pertains to multiple dimensions, including technological infrastructure, human resources, research and development (R&D), and institutional frameworks that foster innovation [12]. Previous studies found that higher innovation capacities put a country in a better position to create novel goods and services, boost output, and adjust to shifting market dynamics [1]. Prior studies have shown a positive relationship between a nation’s innovation

capabilities and economic performance. Compared to nations that do not invest in R&D, human capital development, or robust innovation ecosystems, those that appear to have greater competitive advantages [6]. Strong innovation systems make economies more resilient to shocks from the outside world and better positioned to take advantage of emerging market opportunities. To measure the nations' innovation capabilities, the Global Innovation Index (GII) is a comprehensive indicator providing a framework for assessing a country's innovation performance [4]. The Global Innovation Index (GII) assesses innovation based on two main elements: inputs and outputs. Innovation inputs refer to factors related to institutions, human capital and research, infrastructure, market sophistication, and business sophistication. In contrast, innovation outputs evaluate the tangible results of innovation efforts, such as knowledge creation, technology outputs, and creative outputs [13]. Based on the existing literature, the following hypothesis is proposed:

H1: There is a positive relationship between a nation's innovation capability and its economic growth.

Entrepreneurship has become one of the essential mechanisms driving nations' economies. Entrepreneurs create new businesses, generate employment, and introduce new products or services into markets [2, 5]. Entrepreneurs play a vital role in transforming ideas into viable business ventures, leading to society's and economic dynamism's progress [14]. Entrepreneurship bridges the gap between innovation and economic outcomes and stimulates new ideas for commercialization. To measure entrepreneurship activities of the world, the Global Entrepreneurship Monitor (GEM) introduces the Total Early-Stage Entrepreneurial Activity (TEA) index, which measures entrepreneurship activities in the beginning state of the entrepreneurship process. TEA measures the proportion of individuals actively starting or running new businesses, reflecting nations' entrepreneurial climate [15]. Prior studies found that entrepreneurship activities enhance nations' productivity, leading to economic growth [6]. Entrepreneurs can be broadly classified into two types, which are necessity-driven and opportunity-driven entrepreneurs [16-17]. Necessity-driven entrepreneurs can be described as individuals who start a business because of a lack of other jobs or better employment. This type of entrepreneur is often involved in small-scale ventures with limited growth potential. Although necessity-driven entrepreneurship can reduce short-term unemployment and increase economic activity, it is usually related to lower innovation and economic development [9, 18]. On the one

hand, opportunity-driven entrepreneurs refer to individuals who start their businesses as a result of seeing opportunities or being able to identify the market gaps. Opportunity-driven entrepreneurs tend to create high-growth ventures and introduce innovative products or services, leading to the long-term economic development of nations [19]. Opportunity-driven entrepreneurs play a crucial role in progressing economic dynamism, as they naturally emphasize high-value sectors and have a greater capacity to scale and innovate [17]. Additionally, Robust entrepreneurial ecosystems attract investment and enhance the efficiency of resource allocation, both of which are crucial for long-term economic growth [4]. Based on the existing literature, the following hypothesis is proposed:

H2: There is a positive relationship between entrepreneurial activity and economic growth.

2.2 Corruption and Its Impact on Economic Development

Corruption refers to the abuse of public power for private gain. Corruption is realized as a vital barrier to a nation's economic development [7-8]. Corruption distorts market mechanisms, weakens institutional integrity, and misallocates resources, which entails inefficiencies in the public and private sectors [20]. Corruption takes different forms, including bribery, embezzlement, and nepotism [10]. It harms economic results by raising transaction costs, generating uncertainty, and discouraging investment. Corruption can undermine nations' innovation and entrepreneurship. Resources are often diverted from productive activities toward rent-seeking behavior in high-corruption situations. Entrepreneurs frequently encounter elevated expenses and bureaucratic regulations, which impede innovation and discourage entrepreneurial endeavors [7]. Ventures may focus on short-term benefits rather than long-term gain by abusing government connections or involving in corrupt practices to secure advantages, which destroys competition and prevents entrepreneurial growth. Previous studies showed that corruption entails investment rate reduction, deteriorates institutional frameworks, and negatively affects the returns on innovation and entrepreneurship [8]. Corruption fosters a climate that benefits those already in power and restricts the chances for new businesses to enter the market, impeding overall economic vitality. Corruption is anticipated to discourage entrepreneurship by damaging fair competition and expanding transaction costs, and better control of corruption positively affects entrepreneurship [21]. Higher levels of nascent entrepreneurship and firm entry rates are fostered by institutional environments more favorable to entrepreneurial activity in less corrupt

countries. Additionally, in developing countries, the effect of corruption on entrepreneurship may be severe, as ventures are regularly more vulnerable to rent-seeking behavior and corrupt practices [22].

Previous research has supported the negative association between corruption and the level of innovation [23-25]. In corrupt situations, innovators frequently encounter higher operational costs, which involve paying bribes to gain market access and reduce their capability to invest in research and development (R&D) [23]. Corruption weakens institutional trust, which is necessary for encouraging innovation and entrepreneurship [24]. Because corruption increases transaction costs and reduces incentives for profitable investments, it weakens legal and commercial institutions' basis, discouraging innovation and entrepreneurship. Long-term R&D investments are deterred by corruption since it inhibits entrepreneurs and innovators from recognizing the full value of their ideas because of opportunistic behavior by government officials and other intermediaries. Based on the existing literature, the following hypotheses are proposed:

H3: Corruption negatively moderates the relationship between innovation capability and economic growth.

H4: Corruption negatively moderates the relationship between entrepreneurial activity and economic growth

3. Research methodology

This study employed a quantitative approach. Secondary data from various reputable and reliable sources was obtained to investigate the relationships among innovation capabilities, entrepreneurship, corruption, and economic growth. The sample of 44 countries selected based on complete data availability during 2021-2023 was gathered. The details of variables and data sources are summarized in Table 1.

Table 1: Summary of Variables and Data Sources

Variable	Measure	Source
Innovation Capability	Global Innovation Index (GII)	World Intellectual Property Organization (WIPO)
Entrepreneurial Activity	Total Early-Stage Entrepreneurial Activity (TEA)	Global Entrepreneurship Monitor (GEM)
Corruption Level	Corruption Perceptions Index (CPI)	Transparency International
Economic Growth	GDP	World Bank

To examine the relationships among those variables, the authors collected the data of that measurement, which are the Global Innovation Index (GII), Total Early-Stage Entrepreneurial Activity (TEA), Corruption Perceptions Index (CPI), and Gross domestic product (GDP) of 44 countries. For the innovation capability, entrepreneurial activity, and corruption level, the average values over three years (2021–2023) of GII, TEA, and CPI were calculated to ensure a more stable and representative measure of each variable. Similarly, for the dependent variable, the average values for GDP over the same three-year period (2021–2023) were computed to capture a more consistent measure of economic growth. The details of the secondary data used in the analysis are summarized in Table 2.

Table 2: The details of the secondary data used in the analysis

Country	Avg. GII	Avg. TEA	Avg. CPI	GDP2023	GDP2022	GDP2021	AVG GDP
Brazil	33.43	19.87	36.67	2,173.67	1,920.10	1,649.62	1,914.46
Canada	52.57	18.80	74.67	2,140.09	2,161.48	2,007.47	2,103.01
Chile	34.13	29.33	66.67	335.53	301.02	316.58	317.71
Colombia	30.10	22.43	39.33	363.54	343.62	318.51	341.89
Croatia	36.67	12.93	49.00	82.69	71.60	69.08	74.46
Cyprus	46.40	9.23	52.67	32.23	29.25	29.48	30.32
Ecuador	20.50	32.70	35.33	118.85	115.05	106.17	113.36
Estonia	51.17	13.10	74.67	40.75	38.10	37.19	38.68
France	55.33	9.23	71.33	3,030.90	2,779.09	2,959.36	2,923.12
Germany	57.77	7.90	79.00	4,456.08	4,082.47	4,278.50	4,272.35
Greece	36.10	5.70	50.00	238.21	217.58	214.67	223.49
Guatemala	19.23	30.03	24.00	102.05	95.00	86.05	94.37
Hungary	41.27	9.87	42.33	212.39	177.34	182.09	190.61
India	37.03	12.63	39.67	3,549.92	3,416.65	3,150.31	3,372.29
Iran	31.97	11.67	24.67	401.51	413.49	359.1	391.37
Israel	52.63	9.00	61.33	509.9	525.00	488.53	507.81
Italy	46.13	6.55	56.00	2,254.85	2,049.74	2,155.36	2,153.32
Jordan	28.20	15.70	47.33	50.81	47.45	46.3	48.19
Latvia	38.73	14.53	59.33	43.63	40.88	39.44	41.32
Lithuania	39.73	11.33	61.33	77.84	70.97	66.8	71.87
Luxembourg	49.80	8.00	78.67	85.76	81.64	85.58	84.33
Mexico	32.17	15.50	31.00	1,788.89	1,465.85	1,312.56	1,522.43

Morocco	28.83	5.53	38.33	141.11	130.91	141.82	137.95
Netherlands	59.00	13.47	80.33	1,118.13	1,009.40	1,029.68	1,052.40
Norway	49.97	5.50	84.33	485.51	593.35	503.37	527.41
Oman	28.20	11.67	46.33	108.19	114.67	88.19	103.68
Panama	26.33	27.00	35.67	83.38	76.52	67.41	75.77
Poland	38.37	2.07	55.00	811.23	688.13	681.35	726.90
Qatar	32.60	13.63	59.67	235.77	236.26	179.73	217.25
Republic of Korea	58.57	11.83	62.67	1,712.79	1,673.92	1,818.43	1,735.05
Romania	34.80	7.97	45.67	351	300.69	285.81	312.50
Saudi Arabia	33.23	21.37	52.00	1,067.58	1,108.57	874.16	1,016.77
Slovak Republic	36.90	9.30	53.00	132.79	115.46	118.58	122.28
Slovenia	42.30	7.27	56.33	68.22	60.06	61.83	63.37
South Africa	30.97	12.37	42.67	377.78	405.27	420.12	401.06
Spain	45.30	6.10	60.33	1,580.70	1,417.80	1,445.65	1,481.38
Sweden	62.97	9.13	83.33	593.27	591.72	639.71	608.23
Switzerland	65.90	9.17	82.67	884.94	818.43	813.41	838.93
Thailand	36.40	23.60	35.33	514.95	495.42	505.57	505.31
Ukraine	33.13	19.60	33.67	178.76	160.5	199.77	179.68
UK	60.63	12.43	74.00	3,340.03	3,089.07	3,141.51	3,190.20
USA	62.20	16.80	68.33	27,360.94	25,439.70	23,315.08	25,371.91
Uruguay	30.47	25.20	73.33	77.24	71.18	61.41	69.94
Venezuela	19.30	19.30	13.67	92.21	129.31	111.81	111.11

Note: GII = Average Global Innovation Index (2021-2023), TEA = Average Total Early-Stage Entrepreneurial Activity (2021-2023); CPI = Average Corruption Perceptions Index (2021-2023); Average GDP = Average Gross Domestic Product (2021-2023); GDP in Billion US$

Regression analysis is regularly utilized in economics, political science, and development studies to estimate and predict data trends [26-27]. It is a fundamental instrument for modeling the relationships between dependent and independent variables, presenting an understanding of the strength and direction of these associations. After establishing a multiple regression model, the SPSS software was used for the analysis. In this case, there are two independent variables: innovation capability and entrepreneurial activity. Economic growth is the dependent variable in this study. Additionally, corruption level acts as a moderating variable, affecting the strength or direction of the relationship between the independent and dependent variables.

4. Results

The data from 44 countries were examined to investigate the relationships among innovation, entrepreneurship, and economic growth, with corruption as the moderating variable. A linear regression model was used for this study. The Box-Cox transformation was applied to the dependent variable (GDP) to avoid the non-normality issue, which is one of the prerequisite assumptions of linear regression; the Box-Cox transformation was applied to the dependent variable (GDP). The Box-Cox transformation effectively addresses non-normal distributions and is widely used in regression analyses [28]. The normality requirements for linear regression were achieved by transforming the GDP data, enabling more precise and dependable statistical inferences. The results of the normality testing, shown in Table 3, indicate that the Box-Cox transformed GDP as the dependent variable met the normality criteria (Kolmogorov-Smirnov sig. = 0.200; Shapiro-Wilk sig. = 0.645; Skewness = -0.1121; Kurtosis = -0.2632). These results follow the suggested guidelines for assessing normality [29].

Table 3: The normality testing result

Tests of Normality						
	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Box-Cox GDP	0.075	44	0.200a	0.981	44	0.645
a. Lilliefors Significance Correction						

Descriptives				
			Statistic	Std. Error
Box-Cox GDP	Mean		24.8712	0.0857
	95% Confidence Interval for Mean	Lower Bound	24.6984	
		Upper Bound	25.0440	
	5% Trimmed Mean		24.8678	
	Median		24.8632	
	Variance		0.9892	
	Std. Deviation		0.9946	
	Minimum		22.4673	
	Maximum		26.9048	
	Range		4.4375	
	Interquartile Range		1.2853	
	Skewness		-0.1121	0.225
	Kurtosis		-0.2632	0.441

Pearson's correlation was employed to confirm the relationships between GII, TEA, and GDP. The results showed significant correlations between GII, TEA, and GDP. Specifically, there was a positive correlation between innovation capability (GII) and economic growth (GDP) (r = 0.341, Sig = 0.001), confirming that higher levels of innovation capability are associated with greater economic growth. On the other hand, entrepreneurship, as measured by TEA, showed a negative association with GDP (r = -0.229, Sig = 0.005). The results of the correlation between GII, TEA, and GDP are shown in Table 3.

Table 4: The result of the correlation between innovation, entrepreneurship and economic growth

Symmetric Measures	Value	Asymptotic Standardized Error	Approximate T[b]	Approximate Significance
Innovation and Economic Growth	0.341[a]	0.0852	3.456	0.001[c]
Entrepreneurship and Economic Growth	-0.229[a]	0.0796	2.877	0.005[c]
N of Valid Cases	44			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Note: Economic growth = Box-Cox GDP

Multiple regression analysis was employed to estimate the relationships among innovation, entrepreneurship, and economic growth of nations with corruption as the moderator. The results of the multiple regression analysis, including the main and interaction effects, are shown in Tables 5 to 7.

Table 5: Model summary of linear regression analysis.

Model Summary [b]									
					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	0.743	0.552	0.541	0.7412	0.552	49.87	3	124	0.000

a. Predictors: (Constant), Innovation (GII), Entrepreneurship (TEA), Corruption (CPI), Interaction term GIIxCPI, Interaction term TEAxCPI

b. Dependent Variable: Economic Growth (Box-Cox GDP)

Table 6: ANOVA result of linear regression analysis.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	45.612	4	11.403	17.18	0.000[b]
	Residual	61.892	39	1.587		
	Total	107.504	43			

a. Predictors: (Constant), Innovation (GII), Entrepreneurship (TEA), Corruption (CPI), Interaction term GIIxCPI, Interaction term TEAxCPI

b. Dependent Variable: Economic Growth (Box-Cox GDP)

Table 7: Coefficient result of linear regression analysis.

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	19.612	0.847		23.144	0.000
	Innovation (GII)	0.281	0.067	0.435	4.192	0.000
	Entrepreneurship (TEA)	-0.058	0.016	-0.561	-3.625	0.001
	Corruption (CPI)	-0.021	0.008	-0.278	-2.624	0.025
	Interaction term GIIxCPI	-0.014	0.005	-0.338	-2.312	0.049
	Interaction term TEAxCPI	0.005	0.003	0.092	1.422	0.164

a. Dependent Variable: Box-Cox GDP

Note: Box-Cox GDP = Box-Cox transformation of GDP

As shown in Table 5, the model explains a significant amount of the variation in economic growth. The R^2 value of 0.552 indicates that 55.2% of the variance in economic growth can be attributed to the predictors and their interaction terms. The ANOVA results in Table 6 confirm the significance of the overall model. The F-statistic value of 17.18 ($p < 0.001$) indicates that the combined predictors—innovation, entrepreneurship, corruption, and their interactions—significantly explain the variation in economic growth. The regression coefficients in Table 7

detail the relationships among the variables. Innovation (GII) positively and significantly impacts economic growth ($\beta = 0.435$, $t = 4.192$, $p < 0.001$). Therefore, H1 is supported. On the one hand, Entrepreneurship (TEA) shows a negative and significant association with economic growth ($\beta = -0.561$, $t = -3.625$, $p = 0.001$). Therefore, the Hypothesis 2 (H2) is not supported. The moderating effects of corruption on the relationship between innovation, entrepreneurship and economic growth were examined by considering the interaction's significance level. The interaction between innovation and corruption (GII × CPI) is significantly negative ($\beta = -0.338$, $t = -2.312$, $p = 0.049$), representing that corruption weakens the positive impact of innovation on economic growth. Therefore, H3 is supported. Nevertheless, the interaction between entrepreneurship and corruption (TEA × CPI) is not significant ($\beta = 0.092$, $t = 1.422$, $p = 0.164$). Therefore, Hypothesis 4 (H4) is not supported. The summary of hypothesis testing is shown in Table 8.

Table 8: Summary of hypotheses testing results

Hypothesis	Description	Result	Conclusion
H1: Innovation capability (GII) positively impacts economic growth (GDP).	Higher levels of innovation capability are associated with greater economic growth.	$\beta = 0.435$, $t = 4.192$, $p < 0.001$	Supported
H2: Entrepreneurship rate (TEA) positively impacts economic growth (GDP).	Higher entrepreneurship rates lead to higher economic growth.	$\beta = -0.561$, $t = -3.625$, $p = 0.001$	Not Supported (Negative Impact)
H3: Corruption (CPI) moderates the relationship between innovation (GII) and economic growth (GDP).	Corruption weakens the positive impact of innovation on economic growth.	$\beta = -0.338$, $t = -2.312$, $p = 0.049$	Supported
H4: Corruption (CPI) moderates the relationship between entrepreneurship (TEA) and economic growth (GDP).	Corruption weakens the positive impact of entrepreneurship on economic growth.	$\beta = 0.092$, $t = 1.422$, $p = 0.164$	Not Supported

Figure 1 illustrates the relationships among national innovation capability, entrepreneurship rate, and economic growth of 44 counties.

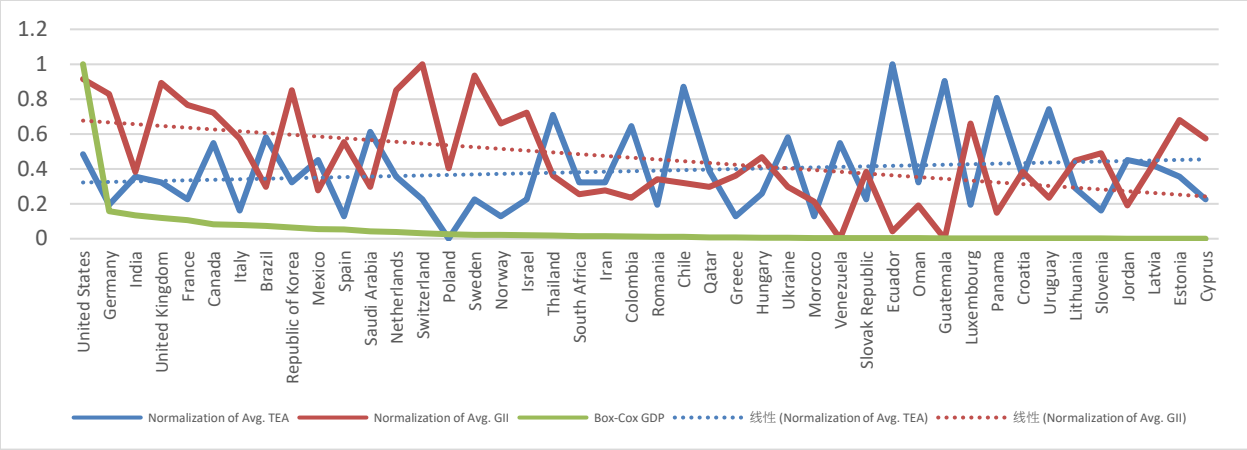

Figure 1.: The relationship among nation innovation capability, entrepreneurship rate, and economic growth of 44 counties

5. Discussion

This study aims to investigate the relationships among a nation's innovation capability, entrepreneurship, economic growth, and the moderation role of corruption in those relationships. Based on data from 44 countries collected for the years 2021-2023 from various sources, which are the Global Innovation Index (GII) for measuring innovation capability, Total Early-Stage Entrepreneurial Activity (TEA) for entrepreneurship rates, Gross Domestic Product (GDP) for economic growth, and the Corruption Perceptions Index (CPI) for corruption levels. A multiple linear regression analysis was used to test the proposed hypotheses. The finding reveals that a nation's innovation capability positively and significantly impacts economic growth. This result is in line with prior studies that innovation plays a vital driver in fostering the economic development of nations [4, 6]. This result also aligns with previous work examining the relationship between innovation, particularly patent grants, and economic growth (GDP per capita) across 166 countries and found a positive correlation between innovation and economic growth [30]. On the other hand, in this study, entrepreneurship showed a significantly negative association with economic growth. This result contradicts previous studies that entrepreneurship drives economic development [31]. However, our finding can imply that the negative association between entrepreneurship and economic growth may reflect the dominance of necessity-driven entrepreneurship in the analyzed countries. In low-income or developing countries, entrepreneurship normally arises from necessity rather than opportunity, and such necessity-driven entrepreneurship can have a negative or neutral impact on economic development

because of a lack of innovation and scalability [32]. This viewpoint aligns with earlier works that differentiate between necessity-driven and opportunity-driven entrepreneurship, where the latter positively affects economic progress [18]. Necessity-driven entrepreneurs are often involved in low-growth ventures, which lead to a weaker contribution to GDP growth. This result suggests that not all forms of entrepreneurship contribute similarly to economic development. The distinguishing between opportunity-driven and necessity-driven entrepreneurship is vital for policy planning. The moderating effect of corruption on the relationships between innovation and economic growth showed that corruption weakens the positive relationship between innovation and economic growth. In countries with higher levels of corruption, the positive impact of innovation on economic growth declined. This result supported the argument that corruption can lower the rate of product innovation by creating an environment where resources are diverted away from productive activities [23]. Corruption significantly impedes innovation output [33-34]. Nevertheless, in our study, the interaction between entrepreneurship and corruption was not found to be significant. This could indicate that corruption may not substantially change the impacts of necessity-driven entrepreneurship, which is inclined to run businesses at a small scale and may be constrained by other factors, such as the limitation of accessibility to resources and markets. As such, corruption might not burden these low-growth ventures substantially. This result calls for further investigation into how corruption affects different types of entrepreneurship and their impacts on economic growth.

This study provides several theoretical contributions. The findings explain how innovation, entrepreneurship, and economic growth relate. The study reinforces the well-established theory that innovation fosters economic growth. Whereas earlier studies regularly highlight the positive influence of entrepreneurship on economic growth, this study reveals that not all forms of entrepreneurship may contribute equally. The negative association between entrepreneurship and economic development specifies that necessity-driven entrepreneurship, widespread in developing countries, can have a neutral or negative effect on growth because of its low levels of innovation and scalability. Additionally, corruption shows the distortion in allocating resources and reducing the effectiveness of innovation in driving economic growth, which emphasizes the critical role of governance and institutional quality in realizing the benefits of innovation-led growth strategies.

The results of this study also provide some key practical implications for policymakers who aim to increase economic growth through innovation and entrepreneurship. Firstly, governments should focus on cultivating innovation capability through research and development investment, public and private collaboration encouragement, and intellectual property protection policies, as these are important fundamental drivers for sustainable economic development. Secondly, governments and policymakers should consider the difference between necessity-driven and opportunity-driven entrepreneur issues and focus on the quality of new or opportunity-driven entrepreneurship rather than the number of new entrepreneurs by enhancing finance accessibility, entrepreneurial education, and innovation-friendly regulations. Thirdly, anti-corruption endeavors are vital. Governments should implement policies that reduce corruption, such as enhancing transparency, improving regulatory frameworks, and minimizing bureaucratic inefficiencies.

6. Conclusion Limitations and Future Research

This study provides to better understanding of the relations among a nation's innovation capability, entrepreneurship, economic growth, and the moderating role of corruption. The results confirm that innovation capability significantly influences economic growth, strengthening the important role of nurturing innovation ecosystems. Nevertheless, entrepreneurship, especially necessity-driven entrepreneurship, showed a negative association with economic growth, implying that not all forms of entrepreneurship contribute similarly to economic development. The moderating effect of corruption weakens the positive impact of innovation on growth, which underlines the necessity for good governance and anti-corruption measures. Whereas the study provides useful contributions, the study has certain limitations. Firstly, the analysis was based on secondary data from 44 countries, which may limit the generalizability of the findings to other global contexts. Secondly, the authors used three-year (2021-2023) data, which may not capture long-term trends. Thirdly, the study focused on national-level variables without accounting for sector-specific dynamics. Future research could address these limitations by extending the sample size, including more countries and a longer timeframe. Further studies could also discover how corruption interacts with different forms of entrepreneurship, such as social, tech-based ventures. Future research should include other institutional factors, such as political stability and regulatory quality, to provide valuable insights

for policymakers to promote sustainable economic growth through innovation and entrepreneurship.

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References

[1] M.E. Porter, Competitive Advantage of Nations: Creating and Sustaining Superior Performance, Simon and Schuster, New York, 2011.

[2] J.A. Schumpeter, R. Swedberg, The Theory of Economic Development, Routledge, 2021.

[3] R. Huggins, H. Izushi, The Competitive Advantage of Nations: Origins and Journey, Compet. Rev. 25 (2015), 458–470. https://doi.org/10.1108/CR-06-2015-0044.

[4] V. Medeiros, C. Marques, A.R. Galvão, V. Braga, Innovation and Entrepreneurship as Drivers of Economic Development: Differences in European Economies Based on Quadruple Helix Model, Compet. Rev. 30 (2020), 681–704. https://doi.org/10.1108/CR-08-2019-0076.

[5] P. Drucker, Entrepreneurship and Innovation: Practice and Principles, Harper Business, New York, 1985.

[6] M. Galindo, M. Méndez-Picazo, Innovation, Entrepreneurship and Economic Growth, Manag. Decis. 51 (2013), 501–514. https://doi.org/10.1108/00251741311309625.

[7] A. Shleifer, R.W. Vishny, Corruption, Q. J. Econ. 108 (1993) 599–617. https://doi.org/10.2307/2118402.

[8] P. Mauro, Corruption and Growth, Q. J. Econ. 110 (1995), 681–712. https://doi.org/10.2307/2946696.

[9] Z.J. Ács, Global Entrepreneurship, Institutions and Incentives: The Mason Years, Edward Elgar Publishing, 2015. https://doi.org/10.4337/9781784718053.

[10] T.S. Aidt, Corruption, Institutions, and Economic Development, Oxf. Rev. Econ. Policy 25 (2009), 271–291. https://doi.org/10.1093/oxrep/grp012.

[11] J. Fagerberg, M. Srholec, National Innovation Systems, Capabilities and Economic Development, Res. Policy 37 (2008), 1417–1435. https://doi.org/10.1016/j.respol.2008.06.003.

[12] C. Freeman, L. Soete, The Economics of Industrial Innovation, Pinter Publishers, London, 1997.

[13] S. Dutta, B. Lanvin, S. Wunsch-Vincent, Global Innovation Index 2022: What is the Future of Innovation-Driven Growth? World Intellectual Property Organization (WIPO), 2022. https://www.wipo.int/en/web/global-innovation-index/2022/index.

[14] S.G. Toma, A.-M. Grigore, P. Marinescu, Economic Development and Entrepreneurship, Procedia Econ. Finance 8 (2014), 436–443. https://doi.org/10.1016/S2212-5671(14)00111-7.

[15] Z. Acs, L. Szerb, E. Autio, The Global Entrepreneurship Index, in: Global Entrepreneurship and Development Index 2016, Springer, Cham, 2017: pp. 19–38. https://doi.org/10.1007/978-3-319-63844-7_3.

[16] P. Reynolds, N. Bosma, E. Autio, S. Hunt, N. De Bono, I. Servais, P. Lopez-Garcia, N. Chin, Global Entrepreneurship Monitor: Data Collection Design and Implementation 1998-2003, Small Bus. Econ. 24 (2005), 205–231. https://doi.org/10.1007/s11187-005-1980-1.

[17] Y. Huang, P. Li, L. Chen, J. Wang, Opportunity or Necessity Entrepreneurship? A Study Based on the National System of Entrepreneurship, J. Innov. Knowl. 8 (2023), 100448. https://doi.org/10.1016/j.jik.2023.100448.

[18] W. Naudé, Entrepreneurship, Developing Countries, and Development Economics: New Approaches and Insights, Small Bus. Econ. 34 (2010), 1–12. https://doi.org/10.1007/s11187-009-9198-2.

[19] O. Stoica, A. Roman, V.D. Rusu, The Nexus between Entrepreneurship and Economic Growth: A Comparative Analysis on Groups of Countries, Sustainability 12 (2020), 1186. https://doi.org/10.3390/su12031186.

[20] D. Treisman, The Causes of Corruption: A Cross-National Study, J. Public Econ. 76 (2000), 399–457. https://doi.org/10.1016/S0047-2727(99)00092-4.

[21] D. Park, K. Shin, Does Corruption Discourage Entrepreneurship?, Asian Econ. Papers 21 (2022), 40–59. https://doi.org/10.1162/asep_a_00855.

[22] G. Avnimelech, Y. Zelekha, E. Sharabi, The Effect of Corruption on Entrepreneurship in Developed vs Non-Developed Countries, Int. J. Entrep. Behav. Res. 20 (2014), 237–262. https://doi.org/10.1108/IJEBR-10-2012-0121.

[23] M. Veracierto, Corruption and Innovation, Econ. Perspect. 32 (2008), 29–39. https://ssrn.com/abstract=1096569.

[24] S. Anokhin and W. S. Schulze, Entrepreneurship, Innovation, and Corruption, J. Bus. Ventur. 24 (2009), 465–476. https://doi.org/10.1016/j.jbusvent.2008.06.001.

[25] J. Wen, H.T. Yin, C.L. Jang, H. Uchida, C.P. Chang, Does Corruption Hurt Green Innovation? Yes – Global Evidence from Cross-Validation, Technol. Forecast. Soc. Change 188 (2023), 122313. https://doi.org/10.1016/j.techfore.2022.122313.

[26] L.S. Aiken, S.G. West, R.R. Reno, Multiple Regression: Testing and Interpreting Interactions, Sage, 1991.

[27] R.M. Baron, D.A. Kenny, The Moderator–Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations, J. Pers. Soc. Psychol. 51 (1986), 1173–1182. https://doi.org/10.1037/0022-3514.51.6.1173.

[28] G.E.P. Box, D.R. Cox, An Analysis of Transformations, J. R. Stat. Soc. Ser. B Stat. Methodol. 26 (1964), 211–243. https://doi.org/10.1111/j.2517-6161.1964.tb00553.x.

[29] J.F. Hair, W.C. Black, B.J. Babin, R.E. Anderson, Multivariate Data Analysis, Pearson, New York, 2010.

[30] M. Gürler, Innovation as an Accelerating Effect on Gross Domestic Product (GDP) per Capita, Eur. J. Res. Dev. 2 (2022), 26-44. https://doi.org/10.56038/ejrnd.v2i3.105.

[31] D. Cumming, S. Johan, M. Zhang, The Economic Impact of Entrepreneurship: Comparing International Datasets, Corp. Gov. Int. Rev. 22 (2014), 162–178. https://doi.org/10.1111/corg.12058.

[32] A.V. Stel, M. Carree, R. Thurik, The Effect of Entrepreneurial Activity on National Economic Growth, Small Bus. Econ. 24 (2005), 311–321. https://doi.org/10.1007/s11187-005-1996-6.

[33] P. Mahagaonkar, Corruption and Innovation: A Grease or Sand Relationship?, Jena Economic Research Papers No. 2008, 017. https://www.econstor.eu/handle/10419/25713.

[34] M. Tomaszewski, Corruption–A Dark Side of Entrepreneurship. Corruption and Innovations, Prague Econ. Papers 27 (2018), 251–269. https://www.ceeol.com/search/article-detail?id=670726.