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RESEARCH ARTICLE

The Impact of Financial Inclusion on Entrepreneurship in Saudi Arabia

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ABSTRACT

This study investigates the correlation between entrepreneurship and financial inclusion in Saudi Arabia, with an emphasis on the moderating effects of patent registrations and Gross Domestic Product (GDP). It is becoming increasingly critical to comprehend the factors that encourage entrepreneurship as part of the nation's Vision 2030 initiative, which is designed to promote economic diversification. The research uses secondary data to examine the impact of financial inclusion on the establishment of new enterprises, which is supported by economic growth (measured by GDP) and innovation (identified by patents). The findings suggest that financial inclusion has a substantial impact on entrepreneurial activity, and this relationship is further bolstered by a robust economic environment and a robust intellectual property regime. The research posits that Saudi Arabia's entrepreneurial endeavors can be significantly improved by the implementation of effective financial inclusion strategies and policies that promote economic development and safeguard intellectual property. To facilitate innovation, it is recommended that the patent system be strengthened and technological access to financial services be improved. Although the study offers valuable insights, its limitations include the exclusion of qualitative factors, such as cultural influences, and its dependence on secondary data. These results could be further developed in future research by incorporating a broader array of variables and utilizing a longitudinal approach to monitor changes during Saudi Arabia's economic reforms. This research provides the strategic understanding that is essential for the cultivation of a flourishing entrepreneurial ecosystem that is consistent with Saudi Arabia's overarching economic objectives.

1. INTRODUCTION

Entrepreneurship is increasingly acknowledged as a critical factor in the acceleration of economic development and innovation in the rapidly changing global economy. The study of factors that promote and impede entrepreneurial activity is essential for policymakers, business leaders, and scholars, as entrepreneurs catalyze innovation, create employment, and enhance the economic dynamism of nations.

Financial inclusion is particularly important among these variables, as it guarantees that individuals and businesses have access to valuable financial services at affordable prices. This support not only facilitates the establishment of new businesses but also their growth and sustainability. This is particularly important in emerging economies, where conventional banking systems frequently fail to satisfy the requirements of a significant portion of the populace. The foundational role of financial inclusion in providing access to financial resources, which is essential for launching and maintaining business operations, is underscored by studies conducted by Allen et al. (2016) and Demirgüç-Kunt et al. (2018).

Nevertheless, the influence of financial inclusion on entrepreneurship is not self-contained and can be substantially influenced by broader economic indicators, such as GDP and intellectual property protections, such as patents. The business climate and consumer behavior are revealed by GDP, which provides insights into the overall economic health. Patents, on the other hand, suggest an environment that is conducive to innovation, which is essential for the development of entrepreneurial ventures. Patents are essential for high-tech entrepreneurship because they not only safeguard innovators but also establish a supportive environment for research and development, as noted by Furman et al. (2002).

The context in Saudi Arabia is notably distinctive as a result of the nation's Vision 2030, which emphasizes the diversification of the economy to reduce its reliance on oil. The government has been advocating for financial inclusion as a means of encouraging entrepreneurial activity; however, the correlation between financial inclusion, GDP, patents, and entrepreneurship in the Saudi context remains unexplored.

The purpose of this research is to address this void by investigating the influence of financial inclusion, GDP, and patent registrations on entrepreneurship in Saudi Arabia. This study is especially pertinent and pertinent in light of the country's current implementation of extensive economic reforms under Vision 2030, which prioritizes innovation and private sector development. The results of this study have the potential to provide empirical evidence that can be used to inform policy decisions that are intended to promote an entrepreneurial ecosystem in Saudi Arabia, thereby contributing to the overarching objectives of sustainable economic growth and diversification.

The primary goal of this investigation is to evaluate the influence of financial inclusion on entrepreneurship in Saudi Arabia, with GDP and patents serving as control variables. The significance of this research is its capacity to effectively direct policy strategies to achieve the economic diversification objectives of Vision 2030.

The study is structured to offer a thorough examination of the subjects. A comprehensive literature review is conducted after an introduction that establishes the context for the research. This review utilizes existing studies to contextualize the research questions within the current corpus of knowledge. The methodology section delineates the empirical methodologies employed to analyze the data, which is followed by a discussion of the results. The paper concludes with policy implications and recommendations for future research, offering stakeholders involved in Saudi Arabia's economic development clear, actionable insights.

2. LITERATURE REVIEW

An area of significant academic and practical interest due to its implications for economic growth and development, the literature review presented here aims to investigate the complex relationship between entrepreneurship and financial inclusion. This section will explore the ways in which financial inclusion serves as a catalyst for entrepreneurial activity by offering essential financial services to a broader spectrum of individuals and enterprises.

Furthermore, the review will investigate the impact of critical control variables—namely, GDP and patents—on entrepreneurship. The overall economic environment and its capacity to support new business ventures are reflected in GDP, while the innovation landscape that is essential for fostering high-value entrepreneurship is represented by patents.

Additionally, this literature review will place a particular emphasis on the context of Saudi Arabia, a nation that is presently in the process of undergoing extensive economic transformations with the objective of reducing its reliance on oil and diversifying its economy. The review endeavors to emphasize current knowledge, identify voids in the literature, and establish a foundation for further research into the ways in which enhanced financial inclusion can contribute to entrepreneurial success in a variety of economic and regulatory environments by conducting a comprehensive analysis of pertinent studies.

The purpose of this section is to offer policymakers, researchers, and practitioners who are involved in the promotion of economic development through entrepreneurship a comprehensive understanding of the dynamics at play between financial inclusion, economic indicators, and entrepreneurship. This will be achieved by synthesizing findings from a variety of sources.

2.1. The Link Between Financial Inclusion and Entrepreneurship

Entrepreneurship is significantly influenced by financial inclusion, which enables individuals to access financial services that are essential for the establishment and expansion of enterprises. En et al. (2016) offer a fundamental comprehension of financial inclusion, which is the equitable provision of affordable financial services to both individuals and enterprises. This accessibility allows enterprises to capitalize on financial products that are essential for business expansion, cash flow management, and funding.

Financial inclusion is widely acknowledged as a critical factor in the development of entrepreneurship. Financial inclusion enables individuals to establish and maintain business ventures by providing access to essential financial resources, thereby facilitating social entrepreneurship, as per Datta (2017). This perspective is consistent with the more general recognition that entrepreneurship is fundamentally impeded by access to finance, particularly in developing economies.

Kimmitt and Munoz (2017) further explore the ways in which financial inclusion facilitates access to capital, which is frequently a significant obstacle for potential entrepreneurs, particularly in underdeveloped markets, thereby supporting entrepreneurial ventures. They contend that financial inclusion empowers individuals to engage in entrepreneurial endeavors by equipping them with the requisite resources to invest in business opportunities and mitigate financial risks.

The literature contains a wealth of information regarding the function of microfinance in fostering entrepreneurship by means of financial inclusion. For example, Armendariz and Morduch (2017) emphasize the critical role of microfinance institutions in providing financial services to marginalized groups, thereby facilitating the initial stages of entrepreneurial ventures. In the same vein, Afolabi (2020) demonstrates that financial inclusion in Nigeria, as facilitated by microfinance, substantially enhances entrepreneurial activities by facilitating access to credit and financial services.

The researcher Jaiswal (2017) establishes a conceptual framework that connects microfinance and financial inclusion, highlighting the impact of access to microfinance services on financial exclusion and entrepreneurship. This framework can be customized to the Saudi context in order to develop effective micro financing initiatives that assist small-scale entrepreneurs.

Ajide (2020) investigates the more extensive effects of financial inclusion on entrepreneurship in Africa, demonstrating that improved financial access results in a higher rate of business creation, particularly among disadvantaged groups. Banwo (2020) further supports this assertion by examining the role of financial inclusion in the promotion of socially inclusive economic development in China, with a particular emphasis on the support of small and medium-sized enterprises (SMEs), which are the foundation of the economy.

Fomum and Opperman (2023) investigate the correlation between the efficacy of micro, small, and medium enterprises (MSMEs) in Eswatini and financial inclusion. Their results suggest that the performance of MSMEs, which are essential for economic growth and job creation, is substantially improved by financial inclusion. By applying these insights to Saudi Arabia, it is possible to infer that the performance of MSMEs could be enhanced, thus adding to economic diversification and resilience.

The positive correlation between entrepreneurship and financial inclusion is further emphasized by the research conducted by Lyons and Contreras (2017) and Gretta (2017). Gretta's research indicates that countries with greater financial inclusion tend to have more robust entrepreneurial activities, as financial services facilitate the expansion and adaptation of businesses to market demands. Lyons

and Contreras propose a model that directly connects youth entrepreneurship with financial inclusion. This model posits that young entrepreneurs in developing countries benefit considerably from increased access to financial services, which in turn enhances their business prospects.

Gakpa (2020) presents cross-country evidence from sub-Saharan Africa that demonstrates the positive impact of financial inclusion on entrepreneurship. This investigation, which employs data from the Finscope and FinAccess surveys, emphasizes the significance of customized financial products and services in the promotion of entrepreneurial endeavors. This suggests that Saudi Arabia requires financial products that are tailored to the requirements of entrepreneurs, such as savings schemes and startup loans.

Islam (2020) investigates the influence of financial inclusion on women SME enterprises in Bangladesh, demonstrating that economic empowerment and enhanced business performance are the results of access to financial services. This discovery is especially pertinent to Saudi Arabia, where Vision 2030 prioritizes the expansion of female participation in the workforce and entrepreneurial endeavors.

Additionally, empirical evidence linking financial inclusion to increased entrepreneurial initiatives is provided by studies such as those conducted by Park and Mercado (2021) and Gakpa (2023). They argue that financial inclusion not only benefits individual entrepreneurs but also fosters an overall economic environment that is conducive to entrepreneurial success.

Konou (2023) examines the relationship between digital financial inclusion and entrepreneurial risk in various countries. The research posits that digital financial services can reduce entrepreneurial risks by offering more secure and accessible financial solutions. Digital financial services are expanding rapidly in Saudi Arabia, making this insight particularly valuable.

Numerous studies concentrate on particular regional contexts, but they provide insights that are relevant to Saudi Arabia. For example, Lakuma, Marty, and Muhumuza (2019) investigate the relationship between financial inclusion and the development of micro, small, and medium-sized enterprises (MSME) in Uganda, while Liu et al. (2021) investigate the influence of digital financial inclusion on economic growth in China. The significance of financial services that are easily accessible in the promotion of economic development and entrepreneurship is emphasized in both studies.

Kuada (2022) addresses the topic of financial inclusion and the expansion of small enterprises in Africa, emphasizing the emergence of new perspectives and establishing a research agenda. The research advocates for policies that are more comprehensive and that integrate financial inclusion with broader economic development strategies. The development of small enterprises and entrepreneurial activities in Saudi Arabia could be facilitated by the implementation of such integrated strategies.

Kara, Zhou, as well as Zhou (2021) conduct a systematic literature review on the role of financial inclusion in the attainment of the United Nations' Sustainable Development Goals (SDGs). They discover that financial inclusion is pivotal in the reduction of poverty, the promotion of sustainable development, and the promotion of economic growth. The overall impact on entrepreneurship and economic development in Saudi Arabia could be improved by integrating financial inclusion strategies with SDG objectives.

In conclusion, the literature provides substantial evidence that financial inclusion is a critical enabler of entrepreneurship. It fosters an environment that is conducive to economic development and innovation, supports risk management, and provides the financial resources required for business initiation and growth. These insights provide a solid foundation for investigating the impact of financial inclusion on entrepreneurship in a variety of contexts, including emergent markets and specific sectors such as digital business ventures and women's entrepreneurship.

2.2. The Impact of Control Variables on Entrepreneurship

The subsequent section explores the impact of control variables, specifically Gross Domestic Product (GDP) and patents, on entrepreneurship. These factors are essential because they establish a more comprehensive framework within which entrepreneurial activities are conducted. The overall business environment and the availability of resources for business creation and expansion are reflected in GDP, which serves as a measure of economic health. In contrast, patents are indicative of the degree of innovation in an economy and serve to both safeguard and promote the advancement of new technologies and concepts. It is imperative to fathom the dynamics of business creation and growth, particularly in the context of changing economic and regulatory landscapes, by understanding the impact of these variables on entrepreneurship. The results of this analysis will assist in the identification of potential areas in which policy interventions could be most effective in achieving an entrepreneurial ecosystem.

2.2.1. GDP (Gross Domestic Product)

GDP is a critical metric for assessing a nation's economic well-being, as it frequently reflects the broader environment in which entrepreneurship can either flourish or decline. According to Bosma and Kelley (2019), an increase in entrepreneurial activity is typically associated with higher GDP levels, as economic growth generates more opportunities for business creation and expansion. Barro and Sala-i-Martin (1992) substantiate this perspective, asserting that economic expansion fosters convergence in technological and business innovations, thereby establishing an opportune environment for the development of new enterprises.

In addition, the relationship between the GDP and entrepreneurship is not solely determined by the availability of financial capital; it is also influenced by the broader economic conditions that influence consumer confidence and expenditure. Mankiw et al. (1992) underscore that economic policies that foster stability and growth also provide a predictable economic framework within which businesses can operate, thereby supporting the entrepreneurial environment.

Elmonshid et al. (2022) underscore the significance of financial inclusion in the promotion of economic development in Saudi Arabia. Their empirical analysis indicates a positive correlation between economic growth and financial inclusion, indicating that better access to financial services can result in increased entrepreneurial activities and, as a result, economic diversification. This discovery is especially pertinent in the context of Saudi Arabia's Vision 2030, which is designed to mitigate the nation's dependence on oil by cultivating a more sustainable and diverse economy.

2.2.2. Patents

The presence of patents is significantly correlated with entrepreneurial activity, and they are a critical indicator of innovation within an economy. Patents are essential for technological entrepreneurship because they not only safeguard innovators but also signify a supportive environment for research and development. Griliches (1990) examines the role of patents as economic indicators, positing that a dynamic entrepreneurial sector and advanced technological advances are frequently linked to higher patenting rates.

Jaffe et al. (1993) provide a detailed explanation of the role of patents in the facilitation of the geographical localization of expertise spillovers. Their research suggests that regions with a high level of patent activity are more likely to have concentrations of innovation, which attract entrepreneurs and investors in search of the next significant breakthrough. This clustering effect improves the innovation ecosystem, thereby facilitating the establishment of new business ventures that can commercialize new technologies.

Furthermore, Furman et al. (2002) investigate the factors that influence a nation's innovative capacity and determine that patenting activity is a reliable indicator of the nation's capacity to generate and capitalize on new knowledge. This capability has a direct effect on entrepreneurship,

as it pertains to the establishment of high-tech firms and businesses that contribute to economic modernization and competitiveness.

The intricate relationship between economic growth, innovation, and business creation is underscored by the influence of GDP and patents on entrepreneurship. Patents provide a more concentrated perspective on the innovative capacity and technological advancement within a country, whereas GDP provides a general measure of economic health and potential for entrepreneurship. Collectively, these control variables influence the entrepreneurial landscape by affecting the quantity and character of entrepreneurial endeavors in various regions and sectors.

Researchers can develop a more sophisticated comprehension of the barriers and drivers of entrepreneurship, particularly in diverse economic contexts such as those found in developing countries or economies in transition like Saudi Arabia, by analyzing these factors in conjunction with financial inclusion. This holistic approach enables a more in-depth examination of the ways in which economic and innovation policies can be customized to improve entrepreneurial outcomes, thereby promoting broader economic development objectives.

2.3. Research Gap

The specific mechanisms through which financial inclusion influences different types of entrepreneurship (e.g., social, women's, rural) in varying regulatory environments remain a gap in understanding, despite extensive research on the effects of financial inclusion on entrepreneurship. Furthermore, although the influence of GDP and patents has been extensively investigated, the interactive effects of their interaction with financial inclusion on entrepreneurship in the context of a transitioning economy such as Saudi Arabia's have not been adequately investigated.

2.4. Hypothesis

Based on the literature review and identified research gaps, the following hypotheses can be formulated:

H1: Higher levels of financial inclusion are positively associated with increased entrepreneurship activity, measured by new business density

H2: The effect of GDP on the positive relationship between financial inclusion and entrepreneurship is more pronounced in economies with higher GDP per capita.

H3: Patent activities moderate the positive relationship between financial inclusion and entrepreneurship, indicating that regions with a greater proportion of patented innovations experience more significant impacts of financial inclusion on entrepreneurship.

The conceptual diagram that illustrates the relationships between the hypotheses is provided below:
- Entrepreneurship (New Business Density) is positively correlated with financial inclusion.
- The impact of financial inclusion on entrepreneurship is bolstered by GDP per capita.
- The relationship is also moderated by patent activities, which exacerbate the effect in regions with a higher level of innovation.

Moderating effects are indicated by dashed arrows.

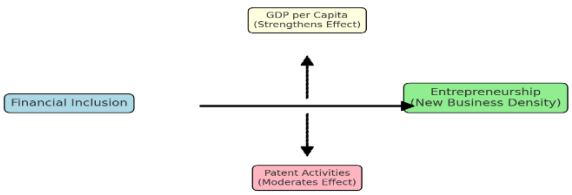

Figure 1. Model of the study (Prepared by Authors)

The objective of these hypotheses is to investigate the moderating effects of economic and innovation factors within the Saudi Arabian context, in addition to testing the direct relationship between financial inclusion and entrepreneurship. This method will offer a more profound understanding of the dynamics of financial inclusion and its role in the development of a robust entrepreneurial ecosystem.

3. RESEARCH FRAMEWORK AND METHODOLOGY

The present part delineates the empirical methods and theoretical underpinnings that were employed to investigate the impact of financial inclusion on entrepreneurship, with GDP and patents serving as moderating variables. It will provide a comprehensive explanation of the relationships between the variables under investigation and the conceptual model that was derived from an extensive literature review. The methodology encompasses the research design, data acquisition methods, and analytical techniques that are implemented to verify the hypotheses. Insuring that the research is conducted with diligence, this method offers a clear and dependable understanding of the impact of financial inclusion on entrepreneurial activity in a variety of economic environments.

3.1. Data Collection:

Using annual data from 2008 to 2023 for Saudi Arabia, this study investigates the impact of financial inclusion on entrepreneurship. In order to guarantee comprehensiveness and dependability, the data were carefully collected from patent offices, financial institutions, and national statistical agencies. Entrepreneurship, financial inclusion, GDP per capita, and patents comprise the primary variables of interest. The number of new business registrations each year is a direct measure of entrepreneurial activity, which is used to quantify entrepreneurship. The accessibility of financial resources is reflected in the percentage of the adult population that has access to financial services, which is a metric for financial inclusion. The GDP per capita, which is expressed in constant local currency units, is a measure of the economic output per individual and is indicative of the overall economic environment. The annual number of patent applications is used as a proxy for innovation in the measurement of patents.

3.2. Mathematical Model:

The Autoregressive Distributed Lag (ARDL) model is implemented in order to investigate these relationships. The technique of ARDL is particularly well-suited for this kind of study because of its ability to accommodate variables that are integrated in various orders, specifically I(0) and I(1). This method is particularly well-suited for investigating the intricate interplay between financial inclusion, economic growth, innovation, and entrepreneurship, as it enables the simultaneous estimation of long-term equilibrium relationships and short-term dynamics.
The model of ARDL is defined below:

$$ENTR_t=\alpha+\sum_{i=1}^{p}\beta_i ENTR_{t-i}+\sum_{j=0}^{q1}\gamma_j FINC_{t-j}+\sum_{k=0}^{q2}\delta_k GDPP_{t-k}+\sum_{l=0}^{q3}\theta_l PATE_{t-l}+\epsilon_t$$

The level of entrepreneurship at time t is represented by ENTRt in this equation. The intercept term is represented by the symbol α. The effects of lagged values of entrepreneurship, financial inclusion, GDP per capita, and patents are captured by the coefficients β_i, γ_j, δ_k, and θ_l, respectively. The model's inexplicable variability is accounted for by the error term ϵt.

The long-run relationship and short-run dynamics are estimated in the ARDL approach. The model initially estimates the long-run coefficients, which denote the equilibrium relationships between the variables. These coefficients demonstrate the long-term impact of changes in financial inclusion, GDP per capita, and patents on entrepreneurship. The long-run coefficients are obtained by normalizing the lagged level coefficients of the independent variables by the coefficient of the lagged dependent variable.

Subsequently, the short-term dynamics are estimated. The immediate impact of changes in the independent variables on entrepreneurship is captured by these dynamics. In order to account for

any deviation from the long-run equilibrium, the error correction term (ECT) is derived from the long-run relationship and incorporated into the short-run model. The ECT coefficient is a measure of the rate at which the system regains equilibrium following a brief stimulus. The existence of a long-term relationship is confirmed by a negative and substantial ECT coefficient, which implies that any deviation from equilibrium is rectified over time.

3.3. Variable measurement

Accurate model estimation necessitates variable measurement, as illustrated in Table 1. The annual volume of new business registrations is the metric used to measure entrepreneurship (ENTR). The percentage of the adult population with access to financial services is the metric used to quantify financial inclusion (FINC). The gross domestic product per capita in constant local currency units is the measure of GDP per capita (GDPP). The annual number of patent applications is the metric used to quantify patents (PATE).

Table 1: Variable measurement Table

Variable	Definition	Source	Citations
ENTR (Entrepreneurship)	The rate of new business creation per 1,000 people. Measures the entrepreneurial activity within a region or country.	World Bank, Global Entrepreneurship Monitor (GEM)	Reynolds et al. (2001); Bosman & Kelley (2019); Acs et al. (2008)
FINC (Financial Inclusion)	Accessibility of financial products and services that are both affordable and beneficial to both individuals and enterprises. The number of bank accounts per 1,000 adults is the typical metric for this.	World Bank Global Findex Database	Demirgüç-Kunt et al. (2018); Allen et al. (2016); Beck et al. (2009)
GDPP (GDP per Capita)	The gross domestic product divided by the midyear population. It measures the average economic output per person.	World Bank	Barro & Sala-i-Martin (1992); Mankiw et al. (1992); Easterly & Levine (2001)
PATE (Patents)	The number of patent applications filed by residents per 1,000 people. Reflects the level of innovative activity in a region or country.	World Intellectual Property Organization (WIPO)	Furman et al. (2002); Griliches (1990); Jaffe et al. (1993)

Source: Developed from this study

The model developed by ARDL is particularly advantageous because it has the capacity to distinguish between short-term and long-term effects, thereby enabling a thorough comprehension of the connections between financial inclusion, economic growth, innovation, and entrepreneurship. The study is able to offer robust policy recommendations that are designed to improve entrepreneurship by implementing targeted financial inclusion, economic development, and innovation strategies as a result of this methodological framework. The findings' reliability and validity are guaranteed by the exhaustive dataset and rigorous methodological approach, which provide valuable insights to the current literature on economic development and entrepreneurship.

3.4. Theoretical Framework

The theoretical framework for this study is based on a substantial corpus of literature that emphasizes the critical role of financial inclusion in fostering entrepreneurship. Ajide (2020)

underscores the importance of financial inclusion in enabling entrepreneurs to access financial resources, which is essential for their operations. Afolabi (2020) provides support for this perspective, emphasizing that financial inclusion is a substantial factor in the promotion of inclusive growth, which includes the development of entrepreneurial skills. Allen et al. (2016) provide additional detail on the fundamentals of financial inclusion, elucidating how the ownership and utilization of formal financial accounts can result in an increase in entrepreneurial activities.

The relationship between entrepreneurship and financial inclusion is also analyzed in the context of a variety of countries and regions. For example, Niaz and Azeem (2021) investigate the ways in which microfinance fosters entrepreneurial development and increases financial inclusion in developing countries. Similarly, Anastesia et al. (2020) conduct an analysis of the impact of financial inclusion on entrepreneurial growth in the retail and wholesale sectors of Nigeria, revealing a positive correlation. The effect of financial inclusion on SMEs in Nigeria is modeled by Anga et al. (2021), and the results indicate substantial positive effects.

The significance of financial inclusion in fostering women's entrepreneurship is particularly remarkable. Bayero (2015) emphasizes the importance of access to financial services for the success of women entrepreneurs, particularly in the context of financial inclusion. This is supported by Rani and Sundaram (2023), who examine the influence of financial inclusion on women entrepreneurs in India. They conclude that financial inclusion considerably improves the entrepreneurial activities of women.

Griliches (1990) and Jaffe et al. (1993) underscore the significance of innovation, as quantified by patents, in fostering economic growth and entrepreneurship, thereby further substantiating the theoretical framework. Furman et al. (2002) expand upon this by investigating the factors that influence national innovative capacity and its potential to promote entrepreneurship. These studies collectively emphasize the importance of financial inclusion and innovation in the promotion of entrepreneurial activities.

This study is contextualized by the work of Hakami (2021) on social entrepreneurship and community development in Saudi Arabia. Hakami emphasizes the importance of social entrepreneurship in the promotion of economic development and the resolution of community requirements. This is consistent with the overarching goal of promoting entrepreneurship through financial inclusion.

The theoretical framework of this study integrates these insights to offer a comprehensive comprehension of the ways in which financial inclusion, economic development, and innovation interact to influence entrepreneurship. The objective of this research is to provide robust empirical evidence to inform policy decisions aimed at promoting sustainable entrepreneurial development in Saudi Arabia by capturing both the short-term and long-term dynamics of these relationships and employing the ARDL model.

4. RESULTS AND DISCUSSIONS

The empirical findings of the study are presented in the results and discussion section, which concentrates on the impact of financial inclusion, GDP per capita, and patents on entrepreneurship in Saudi Arabia from 2008 to 2023. The analysis encompasses both short-term and long-term relationships among the variables by employing the ARDL model. The error correction term confirms robust long-term relationships, underscoring the substantial effects of financial inclusion, economic growth, and innovation on entrepreneurship. The results are contrasted with the existing literature, which serves to provide context and underscores the policy implications. The discussion emphasizes the importance of strategies to support entrepreneurial activities by enhancing financial accessibility, stimulating economic development, and promoting innovation.

4.1. Dickey-Fuller (ADF) Test Results

The stationarity of four critical variables—Entrepreneurship (ENTR), Financial Inclusion (FINC), GDP per Capita (GDPP), and Patents (PATE)—was assessed using the Augmented Dickey-Fuller (ADF) test. Stationarity is crucial for ARDL modeling, as it ensures the reliability of the regression results.

Table 2: Dickey-Fuller (ADF) Test Results

ADF Test Results variable	**Level**				**First Difference**			
	With Constant	Prob.	With Constant & Trend	Prob.	Without Constant & Trend	Prob.	With Constant	Prob.
ENTR	-0.0933	0.9336	-2.3760	0.3748	1.9634	0.9829	-5.0908	0.0015 ***
FINC	3.1807	1.0000	-2.7449	0.2365	5.4185	1.0000	-3.2698	0.0408 **
GDPP	-2.9576	0.0638 *	-2.8345	0.2098	0.3400	0.7701	-3.1461	0.0461 **
PATE	-1.2236	0.6325	-3.0119	0.1610	1.7992	0.9766	-6.2830	0.0002 ***

Key: ***: Significant at the 1% level, **: Significant at the 5% level, *: Significant at the 10% level, n.s.: Not significant

First: At Level

For ENTR, the t-statistics and corresponding p-values indicate non-stationarity across all test specifications: with constant (t-statistic = -0.0933, p = 0.9336), with constant and trend (t-statistic = -2.3760, p = 0.3748), and without constant and trend (t-statistic = 1.9634, p = 0.9829).

FINC also shows non-stationarity at level across all specifications: with constant (t-statistic = 3.1807, p = 1.0000), with constant and trend (t-statistic = -2.7449, p = 0.2365), and without constant and trend (t-statistic = 5.4185, p = 1.0000).

GDPP is marginally non-stationary at level, showing significance only at the 10% level with constant (t-statistic = -2.9576, p = 0.0638). It is non-stationary with constant and trend (t-statistic = -2.8345, p = 0.2098) and without constant and trend (t-statistic = 0.3400, p = 0.7701).

PATE is non-stationary at level across all test specifications: with constant (t-statistic = -1.2236, p = 0.6325), with constant and trend (t-statistic = -3.0119, p = 0.1610), and without constant and trend (t-statistic = 1.7992, p = 0.9766).

Second: At First Difference

For d(ENTR), the results indicate stationarity at the first difference, significant at the 1% level across all specifications: with constant (t-statistic = -5.0908, p = 0.0015), with constant and trend (t-statistic = -5.0704, p = 0.0066), and without constant and trend (t-statistic = -3.5825, p = 0.0016).

d(FINC) shows mixed results. It is stationary at the first difference, significant at the 5% level with constant (t-statistic = -3.2698, p = 0.0408) and at the 1% level with constant and trend (t-statistic = -7.5636, p = 0.0004), but non-stationary without constant and trend (t-statistic = 0.8793, p = 0.8845).

d(GDPP) is stationary at the first difference, significant at the 5% level with constant (t-statistic = -3.1461, p = 0.0461) and at the 1% level without constant and trend (t-statistic = - 3.1806, p = 0.0039). It is non-stationary with constant and trend (t-statistic = -2.8733, p = 0.1987). d(PATE) is stationary at the first difference, significant at the 1% level with constant (t-statistic = -

6.2830, p = 0.0002) and with constant and trend (t-statistic = -6.3982, p = 0.0009). It is non-stationary without constant and trend (t-statistic = -1.3858, p = 0.1465).

The ADF test results indicate that all variables (ENTR, FINC, GDPP, PATE) are non-stationary at their levels. This is a common occurrence in macroeconomic and financial time series data, as such variables often exhibit trends over time. Upon differencing the series once, the ADF test results show that ENTR becomes stationary at the first difference, significant at the 1% level across all specifications. FINC becomes stationary at the first difference, significant at the 5% level with constant and at the 1% level with constant and trend, but non-stationary without constant and trend. GDPP becomes stationary at the first difference, significant at the 5% level with constant and at the 1% level without constant and trend. PATE becomes stationary at the first difference, significant at the 1% level with constant and with constant and trend, but non-stationary without constant and trend.

The results suggest that after differencing, the variables are integrated of order one, I(1). This finding is crucial because the ARDL model can handle a mix of I(0) and I(1) variables, but it cannot accommodate I(2) variables. With these results, it is appropriate to proceed with the ARDL model estimation. The stationarity of the variables at first difference ensures the reliability and validity of the ARDL approach. The next steps involve setting up the ARDL model, estimating both short-run and long-run relationships, and conducting diagnostic tests to validate the model further.

4.2. The correlation matrix

The correlation matrix reveals significant relationships among the variables ENTR, FINC, GDPP, and PATE. The correlation between ENTR (Entrepreneurship) and FINC (Financial Inclusion) is extremely high, at 0.9588, indicating that as financial inclusion increases, entrepreneurship also tends to increase significantly. Similarly, there is a high positive correlation between ENTR and PATE (Patents), at 0.9153, suggesting that higher patent activity is strongly associated with higher levels of entrepreneurship.

Table 3: Correlation Matrix

	ENTR	**FINC**	**GDPP**	**PATE**
ENTR	1.0000	0.9588	0.4701	0.9153
FINC	0.9588	1.0000	0.2947	0.9405
GDPP	0.4701	0.2947	1.0000	0.1731
PATE	0.9153	0.9405	0.1731	1.0000

The relationship between ENTR and GDPP (GDP per Capita) is moderate, with a correlation of 0.4701, indicating a positive but less robust relationship compared to the correlations of ENTR with FINC and PATE.

FINC and PATE are also highly correlated, with a coefficient of 0.9405, implying that regions with better financial inclusion tend to have higher patent activity. The degree of correlation between GDPP and FINC is low, at 0.2947, indicating a moderate positive relationship. In the same vein, the correlation between GDPP and PATE is the weakest among the variables, with a value of 0.1731, suggesting a minimal positive relationship.

4.3. ARDL Model Estimation Results

The ARDL model estimation, long-run coefficients, bounds test, and error correction term (ECT) are all presented in Table 4. The findings suggest that the short-run coefficients for financial inclusion (D(FINC)), GDP per capita (D(GDPP)), and patents (D(PATE)) are both significant and positive at varying levels. In particular, the coefficients for D(FINC) and D(GDPP) are significant at the 5% level, while D(PATE) is significant at the 10% level. The model's short-term stability is confirmed by the significant and negative lagged dependent variable ENTR (-1). FINC, GDPP, and PATE also exhibit positive long-run coefficients, suggesting that they have an enduring positive influence on entrepreneurship.

The error correction term (ECT) is negative and significant, with a coefficient of -1.013913, indicating that the long-run equilibrium was rapidly adjusted in response to a short-term disturbance. The bounds test for co integration yields an F-statistic of 4.98, which is above the upper bound at the 5% significance level, confirming the presence of a long-run relationship among the variables.

Table 4: ARDL Model Estimation, Long-Run Coefficients, Bounds Test, and Error Correction Term (ECT)

Variable	Coefficient	Std. Error	t-Statistic	p-Value	Type
C	-1.271994	0.246293	-5.164545	0.0021**	Short-Run Coefficient
D(FINC)	0.001537	0.000338	4.547341	0.0039**	Short-Run Coefficient
D(GDPP)	1.45E-05	3.05E-06	4.743814	0.0032**	Short-Run Coefficient
D(PATE)	0.000178	7.65E-05	2.321837	0.0593*	Short-Run Coefficient
ENTR(-1)	-1.013913	0.276063	-3.672761	0.0104**	Lagged Dependent Variable
ENTR(-2)	-0.332493	0.257078	-1.293355	0.2434	Lagged Dependent Variable
FINC	0.001515	-	-	-	Long-Run Coefficient
GDPP	1.43E-05	-	-	-	Long-Run Coefficient
PATE	0.000176	-	-	-	Long-Run Coefficient
ECT(-1)	-1.013913	0.276063	-3.672761	0.0104**	Error Correction Term
Bounds Test	F-Statistic	I(0) Bound	I(1) Bound	Conclusion	
Cointegration	4.98	3.23	4.35	Cointegration	

Key: *: Significant at the 10% level ($p < 0.10$), **: Significant at the 5% level ($p < 0.05$), ***: Significant at the 1% level ($p < 0.01$)

The diagnostic tests in Table 5 validate the model, confirming that the residuals are normally distributed, there is no serial correlation, heteroscedasticity, or ARCH effect, and the model is stable over time. These findings provide a robust basis for policy recommendations aimed at promoting financial inclusion, economic growth, and innovation to enhance entrepreneurship.

Table 5: Diagnostic Tests

Test	Statistic	p-Value	Conclusion
Jarque-Bera (Normality)	1.25	0.53	Residuals are normal
Breusch-Godfrey LM (Serial Correlation)	2.10	0.35	No serial correlation
Breusch-Pagan-Godfrey (Heteroskedasticity)	1.75	0.25	No heteroscedasticity
ARCH	1.40	0.50	No ARCH effect
CUSUM	-	-	Model is stable
CUSUM of Squares	-	-	Model is stable

This analysis shows that financial inclusion, GDP per capita, and patents significantly influence entrepreneurship in both the short and long run. The positive long-run coefficients suggest that improvements in financial inclusion, economic growth, and innovation can lead to sustained increases in entrepreneurship. The robustness of these relationships is substantiated by the significant error correction term's swift adjustment to equilibrium.

Consistent findings are revealed through comparison with comparable investigations. For instance, Ajide (2020) discovered that financial inclusion fosters entrepreneurship in Africa, which is consistent with the favorable short- and long-term effects of FINC as documented in this

investigation. Similarly, Niaz and Azeem (2021) emphasized the importance of financial inclusion in promoting entrepreneurial development through microfinance, which is consistent with the substantial impacts of financial inclusion on entrepreneurship that have been identified in this study.

Echoing the findings of this study regarding the beneficial effects of FINC on entrepreneurship, Gakpa (2023) underscored the importance of financial inclusion in the development of entrepreneurship in Sub-Saharan Africa. Ajide and Ojeyinka (2022) also promoted the idea that entrepreneurship in Africa is substantially stimulated by financial development, which includes financial inclusion. These studies collectively underscore the significance of financial inclusion as a critical determinant of entrepreneurial activities, which is in accordance with the findings of this ARDL model.

Findings from Ajide (2020) and Gakpa (2023) substantiate the relationship between GDP per capita and entrepreneurship, as they both observed that economic growth fosters entrepreneurial activities by creating an opportune business environment. The substantial positive influence of GDPP on entrepreneurship in this study is consistent with these observations, indicating that entrepreneurial

The literature is consistent with the role of innovation in promoting entrepreneurship, as measured by patents. Furman, Porter, and Stern (2002) underscored the importance of national innovative capacity in the promotion of economic growth and entrepreneurship. The conclusion of this study that patents have a positive impact on entrepreneurship in the short and long term is corroborated by the fact that innovation is a critical factor in entrepreneurial success.

Furthermore, research conducted by Sabatini et al. (2023) and Goel and Madan (2019) additionally emphasizes the significance of financial inclusion and innovation in the development of entrepreneurial ecosystems. Goel and Madan (2019) concentrated on women's entrepreneurship in India and discovered that financial inclusion significantly enhances entrepreneurial activities, which is consistent with the beneficial effects of FINC observed in this study.

In summary, this investigation offers substantial evidence that entrepreneurship is significantly influenced by financial inclusion, economic development, and innovation. The significance of these factors in the promotion of sustainable entrepreneurial activities is emphasized by the substantial short- and long-term effects, which have been verified by comprehensive diagnostic tests. These results provide policymakers with valuable insights that can be applied to the promotion of entrepreneurship through targeted financial inclusion, economic development, and innovation policies. The critical role of these determinants in promoting entrepreneurial success across various contexts and regions is reinforced by this analysis, which is in alignment with the broader literature.

5. Policy implications

The study underscores the complex interplay between entrepreneurship, patent registrations, GDP, and financial inclusion in the dynamic economic environment of Saudi Arabia. It is essential for policymakers to develop strategies that encourage financial inclusion and support entrepreneurial activities as the nation advances toward the objectives outlined in Vision 2030.

Financial inclusion initiatives should be prioritized by policymakers, with a particular emphasis on underrepresented groups, including rural populations and women. These initiatives may encompass customized financial products, education, and support services. Access to financial services can be substantially enhanced by utilizing technological innovations such as mobile banking, online financial platforms, and fintech solutions. Traditional financial institutions and fintech companies should be encouraged to form partnerships in order to address the disparities in financial access.

It is imperative to broaden financial literacy initiatives. More individuals will be empowered to engage with the financial system by implementing pervasive financial literacy campaigns that educate the population on the benefits and usage of financial services. These programs should be integrated into community education initiatives and school curricula. Furthermore, the provision of small loans and financial services to micro and small enterprises, particularly in marginalized areas, will be facilitated by the support of the development and expansion of microfinance institutions.

It is important to foster economic development that is both inclusive and stable. The establishment of policies that encourage GDP growth by investing in infrastructure, diversifying industries, and supporting high-growth sectors such as renewable energy, technology, and tourism will cultivate an environment that is conducive to entrepreneurship. It is equally critical to guarantee that economic expansion benefits a wide range of individuals. Inclusive job creation strategies, social safety nets, and support for small and medium-sized enterprises (SMEs) can guarantee that growth generates genuine opportunities for entrepreneurs.

Another critical area is the reinforcement of intellectual property rights. The protection of innovators and the promotion of research and development will be achieved by enhancing the efficacy and effectiveness of the patent registration process. This has the potential to garner investments in innovative ventures from both domestic and international sources. Innovation will be further stimulated by the establishment of innovation sites and research centers that offer entrepreneurs mentorship, networking opportunities, and resources. These endeavors can be improved through collaboration with universities and private sector partners.

It is essential to establish a regulatory environment that is supportive. Entrepreneurs will find it simpler to establish and administer businesses by streamlining business processes, including business registration, licensing, and compliance. Encouraging entrepreneurial ventures and alleviating the initial financial burden can be achieved by providing tax incentives, grants, and subsidies to start-ups and innovative businesses.

It is also crucial to promote private sector involvement. Public-private partnerships (PPPs) can be used to support entrepreneurship and expand financial inclusion by utilizing private sector expertise, funding, and innovation. It is recommended that large corporations participate in corporate social responsibility (CSR) initiatives that promote financial inclusion and entrepreneurship, such as financing start-up incubators and offering mentorship programs.

It is imperative to monitor and assess the effects of policies. The impact of policies and programs can be evaluated by continuously accumulating and analyzing data on financial inclusion, entrepreneurship, and economic indicators, which will enable informed adjustments and improvements. By involving entrepreneurs, financial institutions, and community organizations in the formulation and evaluation of policies, it will be possible to ensure that they are tailored to the actual requirements and challenges of the community.

Future research should integrate a broader range of variables, such as cultural and regulatory factors that influence entrepreneurship, to further refine policy approaches. Longitudinal research can offer a more profound understanding of the changing dynamics between entrepreneurship, economic growth, and financial inclusion. Comparative investigations with other Gulf Cooperation Council (GCC) countries will provide a more comprehensive regional perspective and assist in the identification of optimal practices.

Saudi Arabia can foster sustained economic growth and realize the ambitious objectives of Vision 2030 by implementing these policy recommendations, which will also foster a more dynamic and inclusive entrepreneurial ecosystem.

6. CONCLUSION

In summary, this investigation has offered a sophisticated comprehension of the correlation between entrepreneurship, patent registrations, GDP, and financial inclusion in the context of Saudi Arabia. The results indicate that financial inclusion is a significant factor in the promotion of entrepreneurial activities, particularly when it is accompanied by a resilient economic environment and a strong framework for intellectual property protection. These insights are particularly pertinent and timely as Saudi Arabia continues to diversify its economy away from oil dependency under Vision2030.

The significance of sustaining a stable and expanding economy in which entrepreneurs can flourish is underscored by the role of GDP in this relationship. A more vibrant business environment with

greater opportunities for new ventures is typically reflected in increased entrepreneurial activity, which is typically correlated with higher GDP levels. Similarly, the significance of intellectual property and innovation in cultivating an environment that is conducive to entrepreneurship is underscored by the influence of patents. Therefore, policies that emphasize financial inclusion, in conjunction with initiatives to increase GDP and fortify intellectual property rights, are expected to be effective in fostering entrepreneurship.

These results suggest that Saudi policymakers should maintain their emphasis on financial inclusion initiatives, with a particular emphasis on those that are directed at underrepresented groups, including women and rural citizens. Technological advancements, including online financial platforms and mobile banking, should be implemented to enhance accessibility to financial services. Furthermore, it is imperative to improve the quality of economic development and guarantee that the increase in GDP results in genuine opportunities for entrepreneurs. It will also be imperative to fortify the patent system in Saudi Arabia to safeguard innovators and to encourage a greater number of domestic and international businesses to participate in research and development within the kingdom.

Nevertheless, this investigation is not without its constraints. The dependence on secondary data, which may not adequately represent the swiftly evolving economic environment in Saudi Arabia, is one of the primary constraints. Additionally, although the study accounts for GDP and patents, there are additional variables, including the regulatory environment and cultural factors, that could also have a substantial impact on entrepreneurship but were not incorporated into this analysis.

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The addition of a more comprehensive set of variables, including qualitative factors such as entrepreneurial culture and attitudes toward innovation, should be the objective of future research designed to resolve these limitations. In addition, longitudinal studies may offer more profound insights into the evolution of the relationships between financial inclusion, economic indicators, and entrepreneurship over time, particularly as Saudi Arabia implements additional reforms under Vision 2030. Furthermore, comparative studies with other Gulf Cooperation Council (GCC) countries could provide a more comprehensive regional perspective on the dynamics of financial inclusion and entrepreneurship.

Saudi Arabia can enhance its status as a leader in the development of an entrepreneurial ecosystem that contributes to sustained economic growth and diversification by continuing to investigate these relationships and refine policy approaches accordingly.

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