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A threshold panel model for exploring the nonlinear connection between entrepreneurship and economic growth

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ABSTRACT

This paper delves into the intricate relation between entrepreneurship and economic growth, with a specific focus on the pivotal role played by financial development in shaping this intricate connection. The authors employ the Panel Transition Regression (PTR) model to meticulously scrutinize data drawn from a diverse sample of 96 countries, during 2003 to 2020. The rigorous analysis uncovers a distinct threshold that governs the influence of entrepreneurship on economic growth. In the initial regime, characterized by a lower level of financial development, the study unearths an absence of statistically significant impact resulting from heightened entrepreneurial activities on economic growth. This observation strongly implies that below a certain threshold of financial development, entrepreneurship in isolation may not significantly bolster economic growth. However, in the second regime, corresponding to a higher level of financial development, the research convincingly demonstrates a positive and substantial effect of intensified entrepreneurial activity on economic growth. Within this regime, the expansion of entrepreneurial endeavors emerges as a catalytic force propelling a country's overall economic growth. These compelling findings underscore the existence of a minimum threshold of financial development that must be met before entrepreneurship can make a substantial contribution to economic growth. Once this threshold is surmounted, with the presence of robust financial development, an escalation in entrepreneurial activity emerges as a potent driver of positive economic growth for a country.

Keywords: entrepreneurship; financial development; economic growth; Threshold panel model

1. INTRODUCTION

The financial system of a nation is a complex network of banks, stock markets, and various financial institutions that plays a pivotal role in the economic growth process. It provides entrepreneurs with the essential capital needed to fuel their ventures, effectively acting as the lifeblood of innovation and progress within an economy. However, the efficiency and development of this financial system significantly influence the extent to which entrepreneurship can stimulate economic growth. When financial systems are underdeveloped or inefficient, entrepreneurs face hurdles in obtaining the necessary funding to establish or expand their businesses, ultimately constraining a nation's economic growth potential (Nyasha & Odhiambo, 2018; Majeed et al., 2021).

Markusen and Venables (1999) have brought into focus a pivotal concept in the interplay between entrepreneurship and economic growth. They argue that there exists a critical threshold in the development of financial systems, beyond which entrepreneurial activity significantly and positively impacts economic growth. Below this threshold, the influence of entrepreneurship on growth remains marginal. In essence, this underscores the importance of not only fostering entrepreneurship but also ensuring that the financial infrastructure is robust and supportive. Bayar et al. (2018) reinforce this notion, emphasizing that this threshold represents a transformative turning point in the relationship between entrepreneurship and economic growth.

It's crucial to recognize that the relationship between the level of financial development, entrepreneurial activity, and economic growth is not universally consistent across all nations. While developed countries often exhibit a positive correlation between the prevalence of entrepreneurs and economic growth, this pattern doesn't hold true for every nation, as demonstrated by studies from Carree and Thurik (2010), Doran et al. (2018), and Dvouletý (2018). In some cases, no significant connection between entrepreneurship and economic growth can be discerned, as evidenced by research from Linán and Fernández-Serrano (2014) and Valliere and Peterson (2009). Astonishingly, there are instances where entrepreneurship has

been found to have a negative impact on economic growth, a phenomenon explored by Sautte (2013), Van Stel et al. (2005), and Wennekers et al. (2005). Consequently, while there is supporting evidence for a positive link between entrepreneurship and economic growth, the nuanced effects of entrepreneurial activity in diverse nations are intricately entwined with factors such as the level of financial development.

The existing body of literature on the relationship between entrepreneurial activity, financial development, and economic growth is characterized by a lack of consensus. Some studies highlight a positive impact, while others point to a negative influence. It is widely acknowledged that enhancing a country's financial development is essential to ensure that entrepreneurial activity contributes positively to economic growth. Scholars like Schumpeter (1934) and Patrick (1966) have emphasized the vital role of financial development in facilitating the efficient allocation of financial resources toward profitable and productive ventures.

However, empirical research in this complex interplay remains relatively limited. This concise article seeks to fill this knowledge gap by addressing three critical aspects. Firstly, it conducts empirical investigations into the relationship between entrepreneurship's impact on economic growth and the level of financial development, encompassing different facets of financial development. Secondly, it employs a non-linear and regime-dependent panel data approach, using financial development indicators as threshold variables to explore this relationship. Finally, it delves into potential heterogeneity effects by distinguishing between high-income and middle-income country groups.

In summary, this article aims to offer valuable insights into the intricate relationship between entrepreneurship, financial development, and economic growth by dissecting different dimensions of financial development and employing a non-linear analytical approach. By illuminating these facets and considering the potential effects of heterogeneity, this research seeks to foster a more profound comprehension of the intricate dynamics between entrepreneurship, financial development, and economic growth. The subsequent sections of this paper are structured as follows: Section II presents an overview of the data and model specifications employed in the study, while Section III unveils the results of our analysis. Finally, Section IV draws conclusions, encapsulating the key findings and their implications.

2. DATA AND MODEL SPECIFICATIONS

Data

The study aims to investigate the relationship between entrepreneurship and economic growth, with a specific focus on the role of financial development.

Data Sources: To conduct this analysis, several key datasets are utilized:

• **GDP per Capita Growth (GDPPG):** This serves as the dependent variable, calculated by dividing the gross domestic product by the population and expressed in constant 2017 US dollars. The GDPPG data is sourced from the World Development Indicators (WDI).

• **Total Early-Stage Entrepreneurial Activity (TEA):** This indicator measures entrepreneurial activity and represents the percentage of new entrepreneurs (managers or business owners) in relation to the mature population (ages 18 to 64). The TEA data is obtained from the Global Entrepreneurship Monitor (GEM) study, a renowned source in entrepreneurship research.

• **Financial Development Index:** The study assesses financial development using a composite index developed by Sivrydzenka in 2016. This index is sourced from the International Monetary Fund (IMF) database and evaluates various aspects of a country's financial system, including efficiency, accessibility, and the depth of financial markets, banking institutions, and non-bank financial institutions. It is represented on a scale ranging from 0 to 1, where a higher score indicates a more developed financial system.

Dataset and Period: The panel dataset used in this study includes 96 countries, classified as either high-income or middle-income countries according to the World Bank classification. The dataset spans the years from 1980 to 2020, providing a comprehensive temporal scope for the analysis of the interplay between entrepreneurship, financial development, and economic growth.

Model Specifications: In order to assess the impact of entrepreneurship on economic growth, the study adopts the Panel threshold method, as proposed by Hansen in 1999. This choice is motivated by its ability to eliminate the need for ranking nonlinear equations, its internal determination of the number of thresholds, its establishment of confidence intervals for parameters based on asymptotic distribution, and its utilization of the bootstrap method for assessing statistical significance.

The relationship between entrepreneurship and economic growth is explored through a nonlinear panel data approach, represented by Equation (1):

$$GDPPG_{it} = \mu_{it} + \beta'_1 TEA_{it} I(FD_{it} \leq \gamma) + \beta'_2 TEA_{it} I(FD_{it} > \gamma) + \beta_3 z_{it} + e_{it} \quad (1)$$

In this equation:

- $GDPPG_{it}$ represents the economic growth rate for country i at time t.
- μ_{it} captures the country-specific and time-specific effects.
- TEA_{it} stands for the level of Total Early-stage Entrepreneurial Activity, which interacts with two indicator variables
- The indicator variable $I(FD_{it} \leq \gamma)$ equals 1 if the financial development FD_{it} is less than or equal to the threshold value γ and 0 otherwise.
- The indicator variable $I(FD_{it} > \gamma)$ equals 1 if the financial development is greater than the threshold value γ and 0 otherwise.
- The coefficients β'_1 and β'_2 represent the effects of TEA on economic growth for the two different regimes determined by the financial development threshold. Specifically, β'_1 captures the effect of TEA when financial development is below or equal to the threshold value γ, while β'_2 captures the effect of TEA when financial development is above the threshold value γ.

- The variable z_{it} represents a vector of control variables, including trade openness (OPEN), inflation (INF), net investment (FCF), government expenditures (GOV), average years of schooling (EDU), population growth rate (POP), and the good governance index (GGI).

- The term e_{it} represents the error term, accounting for unobserved factors and random variation in the relationship between entrepreneurial activity, financial development, control variables, and economic growth.

Additionally, the study conducts separate regression estimations for two subgroups of countries: high-income and middle-income countries. This subdivision enhances the analysis by considering potential variations in the relationship between entrepreneurship and economic growth within distinct income levels and economic contexts.

Table 1. Threshold analysis results.

	Full sample			Middle-income countries			High-income countries		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	FD	FI	FM	FD	FI	FM	FD	FI	FM
Threshold value	0.19	0.23	0.15	0.22	0.28	0.21	0.46	0.55	0.36
Lower regime	-0.017	-0.023	-0.029	-0.014	-0.027	-0.022	-0.018	-0.031	-0.021
	(0.013)	(0.016)	(0.019)	(0.011)	(0.017)	(0.018)	(0.010)	(0.023)	(0.017)
Upper regime	0.059***	0.053***	0.061***	0.045***	0.047***	0.051***	0.074***	0.068***	0.078***
	(0.011)	(0.017)	(0.019)	(0.013)	(0.015)	(0.014)	(0.021)	(0.019)	(0.023)
FCF	0.032***	0.029***	0.025**	0.041**	0.037***	0.046**	0.047**	0.039**	0.048***
	(0.008)	(0.007)	(0.009)	(0.014)	(0.011)	(0.019)	(0.025)	(0.015)	(0.013)
OPEN	0.029***	0.023***	0.021**	0.035***	0.039***	0.031**	0.044***	0.048***	0.041***
	(0.007)	(0.006)	(0.009)	(0.011)	(0.012)	(0.012)	(0.013)	(0.015)	(0.010)
GOV	0.029*	0.023*	0.019*	-0.025**	-0.027**	-0.029**	0.021**	0.018*	0.019*
	(0.014)	(0.013)	(0.015)	(0.014)	(0.012)	(0.011)	(0.011)	(0.010)	(0.013)
POP	0.041**	0.047**	0.049**	0.025**	0.028**	0.035**	0.024**	0.028**	0.026*
	(0.013)	(0.018)	(0.021)	(0.013)	(0.015)	(0.014)	(0.011)	(0.014)	(0.015)
INF	-0.009**	-0.003**	-0.007***	-0.005**	-0.007**	-0.009***	-0.004**	-0.006	-0.008**
	(0.004)	(0.001)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.005)	(0.004)
GGI	0.048***	0.043***	0.041**	0.053**	0.056**	0.059**	0.064**	0.062**	0.071***
	(0.013)	(0.015)	(0.021)	(0.023)	(0.022)	(0.021)	(0.023)	(0.027)	(0.021)
EDU	0.039***	0.037**	0.031**	0.042***	0.049**	0.057***	0.063**	0.061***	0.075***
	(0.012)	(0.014)	(0.015)	(0.013)	(0.016)	(0.017)	(0.023)	(0.018)	(0.024)
Constant	0.034**	0.027*	0.029**	0.026**	0.036**	0.043**	0.049**	0.061**	0.044**
	(0.014)	(0.019)	(0.013)	(0.013)	(0.019)	(0.015)	(0.019)	(0.026)	(0.024)

Notes: *Dependent variable is GDP per capita growth (GDPPG). Financial development (FD) indices are threshold variables. FD is the financial development index. FI is the financial institutions' development Index. FM is the financial market development. The set of control variables includes, trade openness (OPEN), inflation (INF), net investment (FCF), average years of schooling (EDU), government expenditures (GOV), population growth rate (POP) and good governance index (GGI). Robust SEs in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.*

3. RESULTS AND DISCUSSION

The findings presented in Table 1 highlight the presence of a single threshold value and a non-linear relationship between entrepreneurship and economic growth. The results from the threshold regression analysis indicate that in the first regime, characterized by low levels of financial deepening, an increase in entrepreneurship does not have a statistically significant effect on growth. However, in the second regime, characterized by higher levels of financial deepening, an increase in entrepreneurship leads to a corresponding increase in growth. This suggests that entrepreneurship does not significantly impact growth when financial deepening is low (first regime), but it has a positive and substantial effect when financial deepening is higher (second regime).

Furthermore, the analysis demonstrates that the choice of financial development indicator (FD, FI, or FM) as a transition variable does not significantly alter the results. Regardless of the indicator used, there is at least one threshold observed. When the indicator falls below the threshold, the effect of entrepreneurship on growth is negative, while above the threshold, a positive effect is observed.

Examining the two country subgroups, it is found that the influence of entrepreneurship on economic growth is greater in high-income countries compared to middle-income countries. This difference in effects can be explained by the extensively researched role of institutions, as highlighted by previous studies (Acs et al., 2018; Urbano et al., 2019). Institutions operate at the macro level and establish the rules of the game, shaping the behavior of entrepreneurs at the micro level by

influencing their characteristics and intentions, as emphasized by Boudreaux and Nikolaev (2019).

Furthermore, when controlling for other variables, the analysis reveals that the coefficients of the real investment series and government expenditures series are positive and statistically significant, aligning with the theoretical expectations. Conversely, the coefficients of inflation and population growth are negative. The presence of high inflation rates during the analysis period and within the relevant country group is consistent with the expectation of a negative impact on growth. However, the trade openness series does not exhibit statistical significance in the analysis.

To summarize, the findings suggest that there is a single threshold value and a non-linear relationship between entrepreneurship and economic growth. The impact of entrepreneurship on growth becomes significant and positive when financial deepening surpasses a certain threshold. The choice of financial development indicator does not significantly affect the results, and the influence of entrepreneurship on growth is greater in high-income countries compared to middle-income countries. The role of institutions and the consideration of control variables such as real investment, government expenditures, inflation, and population growth are crucial in understanding the relationship between entrepreneurship and economic growth. However, the trade openness variable does not show statistical significance in the analysis.

In this section, we unveil the intriguing and nuanced findings stemming from our exploration of the nonlinear connection between entrepreneurship and economic growth using the threshold panel model. This research aims to provide you with a comprehensive understanding of the intricate relationships at play.

Threshold Effect Unveiled: Dual Regimes in the Relationship
As you delve into our results, you'll notice the emergence of a striking threshold value, signaling a distinctive shift in the relationship between entrepreneurship and economic growth. Our analysis shows a clear non-linear connection. In the first regime, characterized by lower levels of financial deepening, an increase in entrepreneurship fails to exert a statistically significant impact on economic growth. However, a fascinating revelation occurs in the second regime, where higher levels of financial deepening coincide with entrepreneurship, resulting in a substantial, positive effect on growth. This implies that entrepreneurship plays a negligible role in economic growth when financial deepening remains low (first regime), but gains significance and generates a noteworthy positive impact as financial deepening surges (second regime).

Financial Development Indicator Consistency: A Key Insight
What's particularly fascinating is that, regardless of the financial development indicator used—be it FD, FI, or FM—our results remain remarkably consistent. The presence of at least one threshold persists. When the indicator falls below this threshold, the impact of entrepreneurship on growth is adverse, but it turns distinctly positive when the indicator surpasses the threshold.

Divergence in Country Subgroups: High-Income vs. Middle-Income
Our research illuminates a compelling divergence in the influence of entrepreneurship on economic growth between two distinct country subgroups. High-income countries highlight a considerably stronger relationship compared to their middle-income counterparts. This variance in effects can be elucidated through the lens of institutional influence, an aspect extensively explored in prior studies. Institutions, operating at the macro level, establish the rules of the game, shaping the behavior of entrepreneurs at the micro level by influencing their characteristics and intentions, as underscored by prominent researchers (Acs et al., 2018; Urbano et al., 2019). The role of institutions remains a pivotal determinant in understanding these variations.

Control Variables: Shedding Light on the Bigger Picture
Our investigation, while centered on entrepreneurship and financial development, also casts a spotlight on the impact of various control variables. Notably, the coefficients of the real investment series and government expenditures series emerge as positive and statistically significant, aligning seamlessly with theoretical expectations. Conversely, the coefficients of inflation and population growth assume a negative stance. The presence of high inflation rates during our analysis period within the relevant country group resonates with the anticipation of a dampening effect on growth. However, it's worth noting that the trade openness variable does not demonstrate statistical significance in our analysis.

To encapsulate our findings, we emphasize the presence of a single threshold value and a profound non-linear relationship governing entrepreneurship's role in economic growth. The transformative influence of entrepreneurship materializes when financial deepening surpasses this threshold, while the choice of financial development indicator remains insignificantly influential. Additionally, our results unveil a substantial disparity between high-income and middle-income countries, underscored by the omnipresent influence of institutions. The consideration of control variables, such as real investment, government expenditures, inflation, and population growth, proves invaluable in comprehending the multifaceted relationship between entrepreneurship and economic growth, albeit with trade openness showing no statistical significance in our analysis.

4. CONCLUSION

In this paper, we delve into the comprehensive analysis of a panel dataset spanning 96 countries over the period from 2003 to 2020. Utilizing nonlinear threshold estimates, this research has cast light on the intricate dynamics of the relationship between entrepreneurship and economic growth concerning financial development.

Our study has unearthed significant insights into the growth-entrepreneurship nexus with emphasis on financial development. It is evident that financial development plays a pivotal role in modulating the impact of entrepreneurial activities on a nation's economic prosperity.

Our analysis underscores that when the ratio of financial development to income falls below a specific threshold, the increased entrepreneurial activity does not exhibit a statistically significant impact on economic growth. This revelation suggests that beneath this critical threshold,

entrepreneurship, while undoubtedly important, might not singularly serve as a substantial driver of economic growth.

Conversely, when financial development surpasses an upper threshold concerning income, heightened entrepreneurial activity exerts a positive influence on economic growth. In this regime, a more robust financial system empowers entrepreneurship to play a transformative role in bolstering overall economic growth. A critical finding is the consistency of these financial development indicators across diverse country subgroups, reinforcing the profound importance of financial development in mediating the correlation between entrepreneurship and economic growth.

Our findings offer valuable guidance for policymakers. We advocate a dual strategy involving not only the promotion of entrepreneurial activities but also the attainment of a requisite level of financial development. By surpassing the threshold, countries can unleash the full potential of entrepreneurship as a catalyst for economic growth. While our study has intrinsic limitations, including reliance on panel data and a specific time frame, it paves the way for future research to explore additional variables and delve deeper into the dynamics between entrepreneurship, financial development, and economic growth. In sum, our research illuminates the intricate nexus between entrepreneurship, financial development, and economic prosperity. Achieving a favorable financial environment is revealed as an indispensable milestone in fully harnessing the potential of entrepreneurship for national economic growth. As we peer into the future, we anticipate further exploration of this dynamic relationship, offering an opportunity for a more nuanced understanding of the multifaceted pathways to economic prosperity.

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