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Trade Openness and Entrepreneurship in BRICS Economies: Evidence under Common Global Shocks

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ABSTRACT
The research question in this study is as follows: how strongly domestic economic fundamentals and external integration explain the entrepreneurial activity in the BRICS economies in the years 20012023? The dependent variable of interest is the entrepreneurship where the relationship is analyzed with respect to variable of financial development, technological innovation, economic growth, government support, and trade openness under a dynamic macro-panel framework that clearly considers cross-sectional dependence, heterogeneity, and the global shocks. Using methodologies of second-generation panel unit root and cointegration tests, and then Dynamic Common Correlated Effects Mean Group (DCCE-MG) estimation and panel FMOLS as the robustness method, the research offers new data on the conditional character of entrepreneurship in large emerging markets. The findings indicate that trade openness is the only positive and statistically significant predictor of entrepreneurship when common shocks globally are adjusted. Comparatively, financial development and technological innovation have weak or negative impacts whereas economic growth and government support have estimator-dependent or non-robust impacts. These results indicate that BRICS economies have domestic financial systems and innovation systems that tend to be exclusionary or incumbent-biased and therefore not able to support entry by broad based entrepreneurship. On the whole, the paper shows that domestic fundamentals take back seat to external market integration in the conditions of global interconnectedness in the entrepreneurship, and has significant implications to the entrepreneurship policy, trade strategy, and institutional reform in developing countries.

Keywords: *Entrepreneurship, Financial Development, Technological Innovation, Economic Growth, Trade Openness, BRICS, Government Support, CS-ARDL.*

1. Introduction

Entrepreneurship is broadly considered as a core driver of economic change, diffusion of innovation and sustainable growth. In line with the growing number of emerging and middle-income economies, policymakers turn to entrepreneurial activity as one of the ways in which technological advancements, financial deepening, and global integration can be converted into productive employment and inclusive development (Acs et al., 2023; Urbano et al., 2019). In that regard, BRICS countries Brazil, Russia, India, China, and South Africa, hold a central gateway in the world economy with a significant portion of the global output, the trade,

technologic activity, and entrepreneurial potential. Within the last 20 years, these economies have worked on aggressive development policies that are focused on financial development, technological advancement, and more integration with the global markets.

Even with these attempts, the results of entrepreneur activity in the BRICS economies are still uneven and, at best, unresponsive to the innovation-based approaches in growth. Technological innovation has grown at a faster rate especially by means of more patenting, greater levels of digitalisation, and state sponsored research and development; however, the entry of entrepreneurs and new business start-ups at the initial stage have not grown accordingly. The underlying question of this disconnect is the central question of development economics and entrepreneurship studies: why is it that innovation-based growth is not always turned into entrepreneurial dynamism in emerging economies?

Conventional Schumpeterian and endogenous growth models assume a positive association between entrepreneurship and innovation, whereby the creation of new knowledge creates opportunities and reduces entry barriers to entrepreneurship, and encourages the formation of new firms (Schumpeter, 1934; Romer, 1990). Yet, there are empirical signs of mounting evidence indicating that this mechanism is extremely context-dependent. Large companies, state-owned corporations, or politically affiliated usually hold an innovation monopoly in an emerging economy, which inhibits the spread of knowledge and creates an obstacle to newcomers in the business (Arocena and Sutz, 2002; Cirera and Maloney, 2017). In these circumstances, technological advancement can be accompanied by ineffective entrepreneurial engagement or even by the large and new firms crowd out.

Another and more relevant aspect to this debate is that of international integration and openness to trade. To BRICS economies, trade liberalization has heightened their vulnerability to the demands of the global market, technological flows and competition. Although trade openness has the potential to increase market opportunities to entrepreneurs, it may also enhance or reinforce scale advantages to incumbents, enhance import competition, and pass external shocks, which will disproportionately impact small and young firms. The common global shocks have been further highlighted by the recent world events such as financial crisis, supply-chain shocks and geopolitical fragmentation that have contributed to domestic entrepreneurial performance. However, the interplay between trade openness, innovation and entrepreneurship due to such common shocks has not been researched in detail.

More importantly, the capacity of innovation and trade openness to enhance entrepreneurship does not just rely on the market forces alone, but also on the governmental assistance and institutional capabilities. BRICS economies have governments that actively influence their financial systems, innovation policy, industrial strategy as well as regulation. Theoretically, the government support increased entrepreneurship by righting market failures, facilitating access to finance, and nutrition of innovation. As a matter of fact, though, the state can also push innovation to capital-intensive, state-congruent, or incumbent-based sectors by imposing externalities, undermining the entrepreneurial mechanism of transmission (Mazzucato, 2018; Acemoglu et al., 2019).

Although it is a significant subject, the current empirical research experiences three major shortcomings. To start with, the majority of the research analyzes the financial development, technological innovation, or trade openness separately, but does not consider them as a force

that synergistically operates within a single network of entrepreneurial activity. Second, the roles of government support are generally modelled as the direct determinants of entrepreneurship and little consideration is given on the moderating influence of government support in conditioning the translation of innovation and openness into entrepreneurship. Thirdly, most of the evidence is based on the methods of the statical or first-generation panel that neglects cross-sectional dependence and global shocks which may be notably applicable to highly integrated economies like the BRICS.

The paper fills these gaps by considering the nexus of financial development, technological innovation, economic growth and entrepreneurship in the BRICS economies; especially the role of trade openness and government support in determining the outcome of entrepreneurship in the face of common global shocks. Methodologically, the paper uses a dynamic Cross-Sectionally Augmented ARDL (CS-ARDL) model, which clearly addresses cross-sectional dependence, nonhomogeneous response of countries, and dynamic adjustment. The models of entrepreneurship use financial development, technological innovation, economic growth, and trade openness as key explanatory variables and the government support as one of the key institutional conditioning factors.

The research contributes three things in the literature. First, it presents strong dynamic evidence that trade openness becomes an overriding influence of entrepreneurship in BRICS economies when the common shocks are considered and that these common shocks are more explanatory as compared to innovation and growth. Second, it shows that technological innovation is not necessarily beneficial to entrepreneurship in the presence of a high level of intervention or incumbent oriented institutions. Third, it further develops the research on entrepreneurship with respect to the non-neutral effect of government support that at the same time can boost entrepreneurship itself and undermine the entrepreneurial compensation of innovation.

The study, by merging the innovation, trade, and institutional views on the second-generation panel model presents novel information concerning the reasons why entrepreneurship continues to be unresponsive to innovation-induced development policies in the developing economies. The research results have significant policy implications in designing trade, innovation and entrepreneurial policies in BRICS as well as other emerging market environments.

2. Literature Review

2.1 Theoretical Foundations

Entrepreneurship has traditionally been viewed as a key mode by which economies are able to produce innovation, jobs, and various structural change. Classical theories, led by Schumpeter (1934), view entrepreneurship as a creative destruction process, in which new companies bring about innovations that change market structures and conditions to lead to long-run economic growth. Although this viewpoint highlights the transformational nature of entrepreneurs, recent scholarship is focusing more and more on the fact that entrepreneurial action is not a solitary concept but, instead, is thoroughly embedded in more macroeconomic, institutional and global contexts.

The current theories of growth especially the endogenous growth theory give a central role in long-run growth to knowledge accumulation, innovation and market growth (Romer, 1990;

Aghion and Howitt, 1998). The role of entrepreneurship in that context is to represent the channel by which new technological and economic opportunities are transformed into productive activity. The achievement of these opportunities, however, is critical in the institutional environment around them. The institutional theory emphasizes the significance of quality governance, efficiency in regulations and rule systems in the incentive formation, uncertainty minimization, and distribution of resources to productive entrepreneurship (North, 1990; Urbano et al., 2019).

These views overlap with the international trade theory in the more open and inter-linked economies. Trade openness changes relative prices, increases market size, increases competition, and it promotes cross-border knowledge spillovers. Consequently, open economies can be strongly influenced by forces in the world at large, rather than national basics. This is especially applicable to the large emerging economies like the BRICS, which are highly embedded into the global trade, financial and technological network (UNCTAD, 2023; World Bank, 2022).

The current theoretical developments thus view entrepreneurship in emerging economies as the result of interactions between local economic backgrounds, including financial development, innovation capacity, and economic growth, and external forces that are relayed through globalization and common global shocks (Audretsch et al., 2024; Chudik and Pesaran, 2015). It is based on this combined outlook that this paper will consider the assertion as to whether trade openness has a dominant role to play in entrepreneurship as compared to domestic fundamentals in the BRICS economies.

2.2 Financial Development and Entrepreneurship

The contact between financial development and the entrepreneurship takes up a hub position in the development and finance literary. The traditional financial intermediation theory holds that established financial systems lessen information asymmetries, transaction costs and credit restrict, allowing entrepreneur to obtain external finance and also start new enterprises (Beck and Demirguc-Kunt, 2006; Levine and Rubinstein, 2013). In this perspective, the entrepreneurial activity should be provoked by the financial depth and efficiency.

This linear perspective is however challenged by the increasing empirical evidence emerging in the new economies. It is becoming established the financial development can also be disproportionately advantageous to large firms or state-owned enterprises or other politically-linked participants, whereas small and new entrepreneurs are still credit constrained (Khwaja, and Mian, 2005; Ayyagari et al., 2024). The idea of financial deepening in such situations is not always associated with extensive entrepreneurial dynamism and may even contribute to market concentration.

In addition, the financial systems of open economies are very vulnerable to the world financial cycles and international capital flows. International shocks are also able to divert local credit to either low risk or high returns, undermining the relationship between local financial development and risk-taking in entrepreneurship (Rajan and Zingales, 2003; World Bank, 2022). In turn, the finance-entrepreneurship nexus could be conditional on the macroeconomic situation in the world rather than the domestic financial indicators.

On the one hand, because of the high contribution of the state in the sphere of finance, the heterogeneity of the quality of the institutions and the exposure to global financial shocks in

the BRICS economies, the new data indicate that financial development is not a firm determinant of entrepreneurship on top of cross-sectional dependence and worldwide interdependence (Dutta and Meierrieks, 2021; Estrin et al., 2022).

2.3 Technological Innovation and Entrepreneurship

It is commonly represented that technological Innovation is a main driving force behind entrepreneurship via spillovers of knowledge, creating opportunities, and increasing productivity. The theory of knowledge spillover of entrepreneurship states that investments in research and development create idle or unutilized knowledge that can be converted to the new firm by entrepreneurs (Audretsch and Keilbach, 2007, Acs et al., 2014).

Although this theoretical basis is very strong, emerging markets have shown in recent times that the relationship is not that easy-cut. Most of the developing and emerging markets have innovation systems that are highly concentrated, highly involved by the state, and poorly diffused. Large companies, multinationals, or state-owned organizations are considered to be involved in innovation work where innovation outputs (like patents) are produced with fewer spillovers to the entrepreneurship (Cirera and Maloney, 2017; Ayyagari et al., 2024).

In addition, innovation within an institutionally inflexible or highly regulated setting can increase barriers to entry instead of decreasing them. Entrepreneurs also are not always provided with complementary resources, capital, or enforceable intellectual property rights to commercialise innovation into business opportunities (Kafouros and Forsans, 2012; Mazzucato, 2018). Thus, there can be innovation-based growth and poor entrepreneurship entry especially in innovation policy that focuses more on technological modernization rather than entrepreneurial diffusion.

In the BRICS economies, the development of technology has mainly been a government-pioneered initiative and large incumbents. This leads to a potential that innovation can crowd out, as opposed to spurring entrepreneurial action, particularly in the circumstances of global competitive rivalry and structural change (Estrin et al., 2022; Audretsch et al., 2024).

2.4 Economic Growth and Entrepreneurship

The connection between entrepreneurship and economic growth is ambiguous in theory and disputed in practice. On the one hand, increased level of income, increased market size, and better infrastructure that accompanies economic development can promote opportunity-based entrepreneurship. Conversely, the growth can be counter-cyclical to necessity-based entrepreneurship because it increases the formal employment opportunities (Stam and Van Stel, 2011; Aparicio et al., 2016).

According to recent research, the nexus growth-entrepreneurship is very contextual and governed by the institutional quality, market structure and openness to trade. Capital-intensive (or natural resource-based) or externally driven growth spurrers can create limited entrepreneurial spillovers (Rodrik, 2008; Tahir and Burki, 2023). In addition, expansion in line with the international business cycles could be an indication of external shocks and not internal entrepreneurial ability.

In the case of BRICS economies, which significantly rely on the world production and trade systems, the level of economic development tends to depend on the prices of commodities, the demand in other countries, and the international economic situation. Consequently, this means that domestic growth might not necessarily turn into an increase in entrepreneurship

unless it is either backed by inclusive institutions or unrestricted markets (Urbano et al., 2019; UNCTAD, 2023).

2.5 Trade Openness as the hegemonic Entrepreneurship driver

Trade openness has been found to be an important medium through which globalization determines the outcomes of entrepreneurship. Ideally, openness increases the market size, competition, access to foreign inputs and technologies, and exposes local companies to international best practices all of which are capable of triggering entry into entrepreneurship (Wong et al., 2005; Estrin et al., 2022).

Empirical studies indicate that in certain economies especially emerging ones trade openness can have a more significant effect on entrepreneurship compared to domestic financial or innovation measures. Access to export markets, membership in global value chains, and exposure to foreign demand can help to maintain entrepreneurial activity even in environments with imperfect financial systems or a low level of diffusion of innovations (Kantis et al., 2020; Mai et al., 2025).

Common global shocks, including financial crises, technological shocks, and supply-chain shocks are also transmitted between countries through trade openness. These common shocks are capable of coordinating entrepreneurial processes, which make the influence of purely domestic factors (potentially) less explanatory (Chudik and Pesaran, 2015; OECD, 2022).

Trade openness is one of the major structural characteristics of domestic entrepreneurship in the BRICS context that connects the domestic entrepreneurship with the international markets. The study is relevant to the literature because it explicitly checks the hypothesis that trade openness is dominant over the domestic fundamentals in the determination of entrepreneurship after international shocks that usually affect the world have been effectively controlled.

2.6 Government Support as a Moderator

The role of government support in entrepreneurship is complicated and multifactorial. According to the institutional theory, uncertainty can be minimized through proper governance, quality of regulations, and favorable public policies to prevent the exploitation of property rights, as well as, to promote entrepreneurial risk taking (North, 1990; Urbano et al., 2019). But markets can be distorted by too much or too poorly conceived intervention, giving credence to the established, and choking out the private initiative.

The emerging literature is more conceptual in its approach of seeking to define government support as a moderating and not a direct determiner of entrepreneurship. The institutions define the transformation of financial development, innovation, growth, and openness into entrepreneurial outcomes (Samadi, 2019; Estrin et al., 2022). High levels of government participation in innovation-intensive settings could shift the innovation focus to the strategic or state-driven goal, restricting its spread to the entrepreneurial initiatives.

When the government subsidizes entrepreneurs in an open economy that faces shocks in the international economy, it can offer them protection against fluctuations or it can inject some rigidity to reduce the flexibility. With the high profile of state in coordinating economic activity in the BRICS economies, moderating effects of government aids are key to the entrepreneurship-trade nexus.

2.7. Conceptual Framework and Hypotheses Development

Based on the theoretical and practical literature presented above, this paper puts forward a conceptual framework within which the forces of entrepreneurship are influenced both by domestic economic fundamentals and external global forces.

Openness to trade is postulated to influence entrepreneurship through a direct and overriding positive impact by increasing market access and getting domestic firms involved in global value chain. Weaker or conditional effects are predicted in financial development, technological innovation, and economic growth especially after the common shocks in the world have been taken into consideration.

The government support is also taken as a moderating variable which conditionalizes the effects that the domestic fundamentals have on the entrepreneurial outcomes instead of being a driver on its own.

To that end, the hypotheses of the study are:

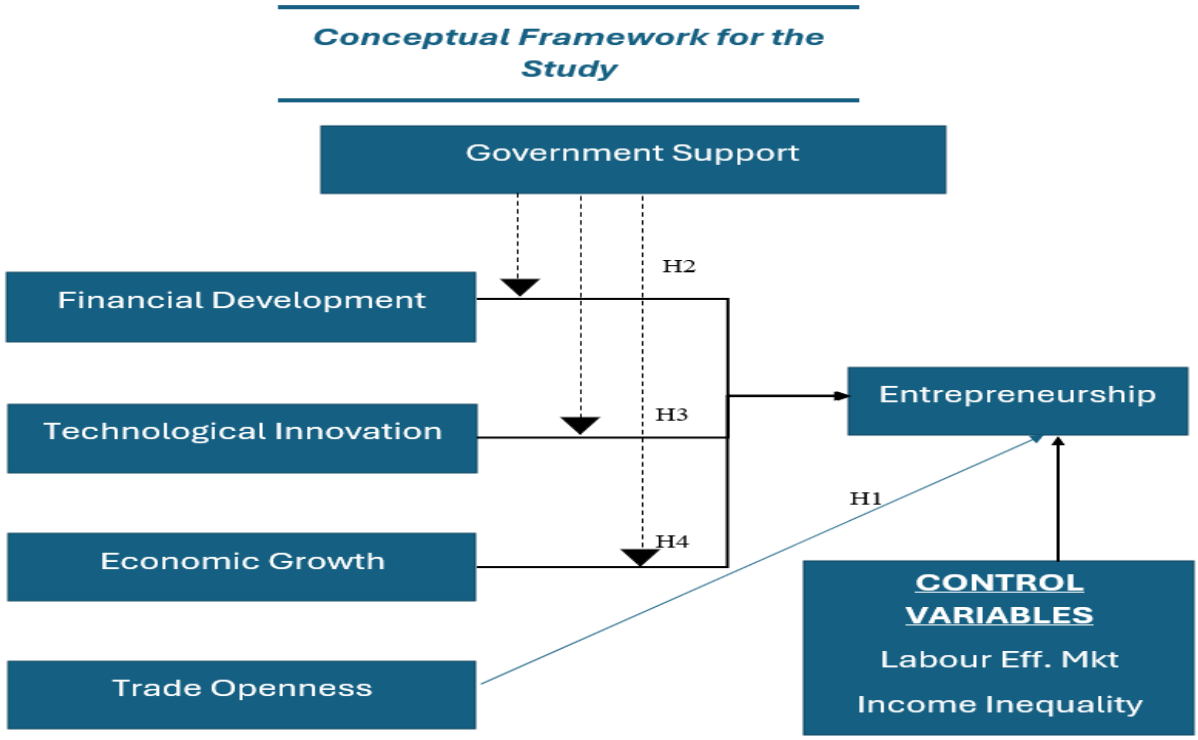
H1: Trade openness and entrepreneurship are positively related.

H2: Financial development and entrepreneurship are positively related.

H3: Technological innovation and entrepreneurship are positively related.

H4: Economic growth and entrepreneurship are positively related.

Figure 1: Conceptual Framework



3. Methodology

3.1 Data and Sample Description

This paper utilizes a balanced macro-panel data of the five BRICS economies Brazil, Russia, India, China and South Africa that includes the year 2001-2023. The BRICS economies offer a perfect empirical environment because they are fast-tracking their integration to the global markets, growing in the sphere of innovation, and they are diversified in their institutional

frameworks, on the one hand, but they face the same global shocks like financial crisis, shifts in the price of commodities, and the global policy cycles, on the other hand.

The data on entrepreneurship is obtained with the help of Global Entrepreneurship Monitor (GEM) which offers internationally comparable indicators of the early-stage entrepreneurial activity. The macroeconomic and institutional variables are obtained based on the World Development Indicators (World Bank) and the additional international databases. The panel design has a moderate time variation (T = 23) and a small cross-sectional dimension (N = 5), which requires econometric methods that can take into account non-homogenous macro-panels.

3.2 Definitions and Measurement of variables.

3.2.1 Dependent Variable

Entrepreneurship (ENT)

Total Early-Stage Entrepreneurial Activity (TEA) is a proxy of entrepreneurship that is the proportion of the adult population engaged in the creation or operation of a new business within the first 42 months. TEA is used in cross-country entrepreneurship studies as it is consistent and available meaning it captures both necessity-driven and opportunity-driven entrepreneurship.

3.2.2 Key Explanatory Variables

Trade Openness (TOP)

The openness of trade is a ratio of total trade (exports and imports) to the GDP. This variable measures the level of openness to global markets and it is the main avenue through which external demand, rivalry and global shocks affect entrepreneurial activity.

Financial Development (FD)

Financial development is built as a composite index through Principal Component Analysis (PCA) and the indicator of banking depth, credit provision, and financial intermediation is used. The index captures the size and the activity of the financial system as opposed to the access to finance.

Technological Innovation (TINN)

Technological innovation is also gauged by indicators of output and capacity of innovation such as patent activity and proxy of R&D. This variable explains the level of technological development in any economy.

Economic Growth (EG)

Economic growth is calculated as the growth rate of the real GDP in a year and this measures the macroeconomic growth and aggregate demand in the economy.

3.2.3 Institutional Variable

Government Support (GS)

The government support is also built as an index formed in PCA, which is a combination of indicators of regulatory quality, government effectiveness, and the systems of the support of the public sector of the business activity. The index indicates the institutional climate in which the entrepreneurship is in operation.

3.2.4 Control Variables

The empirical models incorporate standard controls that are generally applicable to the entrepreneurship research:

- Unemployment (UNEMP): measures essential entrepreneurship processes.
- Income Inequality (GINI): demonstrates distributional limitations in becoming an entrepreneur.

Table 1: Brief description of the data under study

Variable	Abbreviations	Measurement	Source
Entrepreneurship	Entr	Total Early-stage Entrepreneurial Activity (TEA)	GEM
Financial Development	FD	Financial Development Index	WDI
Technological Innovation	TINN	Patent Applications by Residents/Non - residents	WDI
Economic Growth	EG	GDP per capita (constant 2015 US$).	WDI
Government Support	GS	Rule of Law, Control of Corruption, Government Effectiveness, Regulatory Quality, Voice and Accountability and Political Stability and Absence of Violence/Terrorism	WDI
Trade Openness	TOP	Trade % of GDP	WDI
Labour market efficiency	LME	Unemployment Rate	WDI
Income Inequality	II	GINI Index	WDI

Sources: Authors

3.3 Cross-Sectional Dependence Preliminary Diagnostics

Since the BRICS economies show close economic and financial interconnections, cross-sectional dependence (CSD) is quite a possibility. Such dependence may be ignored and this results in biased inference in macro-panel models.

Formal assessment of this issue is carried out by the study through the use of Pesaran (2004) cross-sectional dependence test, which tests the null hypothesis of cross-sectional independence. The test outcomes indicate statistically significant cross-sectional dependence between many of the core variables especially trade openness, financial development, technological innovation, and economic growth which is evidence of the common shocks and spillover effects of global shocks.

These results develop a good econometric reason that supports the use of second-generation panel estimators that directly consider unobserved common factors.

3.4 Model Specification

The empirical relationship at the baseline is given as:

$$ENT_{it} = \alpha_i + \beta_1 TOP_{it} + \beta_2 FD_{it} + \beta_3 TINN_{it} + \beta_4 EG_{it} + \beta_5 GS_{it} + \gamma X_{it} + \varepsilon_{it}$$

where i denotes country, t denotes time, and $X_{it}$is a vector of control variables.

A dynamic specification is then used to capture persistence in entrepreneurial activity:

$$ENT_{it} = \phi_i ENT_{it-1} + \sum_{k=0}^{p} \beta_k Z_{it-k} + \mu_i + \varepsilon_{it}$$

where Z_{it} represents the explanatory variables and the terms of interaction.

3.5 Estimation Strategy

3.5.1 CS-ARDL / DCCE-MG Estimator (Main Estimator)

The estimation type that will be employed in the given study is the Cross-Sectionally Augmented Autoregressive Distributed Lag (CS-ARDL) model, which is carried out with the help of Dynamic Common Correlated Effects Mean Group (DCCE-MG) estimator (Chudik and Pesaran, 2015). This approach:

- Unobserved common shock controls on cross sectional averages,
- Admits heterogeneous short run dynamics between countries,
- Lags dynamic accommodation using dependent variables,
- Is suitable to small N, moderate T panels.

This estimator is especially suitable in the light of the cross-sectional dependence that is recorded and the theoretical focus on global shocks.

3.5.2 Interaction Effects

In order to study the conditional role of institutions, the terms of interaction between the variables of governmental support and important structural variables are proposed, with special attention paid to:

- $TINN \times GS$

These interactions confirm or refute whether the institutional quality enhances or reduces the entrepreneurial effect of innovation in the global integration.

3.5.3 Robustness: FMOLS and DOLS

As the robustness tests, the research uses Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) estimates to recover long-run cointegration relationships. These estimators adjust the endogeneity and serial correlation, but fail to measure the cross-sectional dependence as well as CS-ARDL. They are therefore viewed as corroborating pieces of evidence, as opposed to inferential ones.

3.6 Identification and Causality Considerations

All these concerns are alleviated by both dynamic specification and the inclusion of lagged dependent variables, as well as using cross-sectionally augmented estimators. This empirical strategy enhances causal interpretation especially in terms of the superiority of trade openness to country-specific heterogeneity, by eliminating common international shocks and country-specific heterogeneity.

4. Results and Discussion

4.1 Descriptive Statistics

Table 2 shows the descriptive statistics of the entrepreneurship, financial growth, technological innovation, economic growth, government support, trade openness, and control variables of the BRICS economies in the years 2001 to 2023. The summary statistics will give valuable initial understanding of the distributional characteristics and intercountry dispersion of the variables before the econometric estimation.

Entrepreneurship, as the measure of Total Early-Stage Entrepreneurial Activity (TEA) provides a mean of 8.42 percent at a relatively high standard deviation of 4.15, showing considerable heterogeneity in the entrepreneurial activity both within BRICS countries and time. The large gap between the lowest (1.90) and the highest (19.60) values imply significant variations in entrepreneurial intensity, which represent the disparity in the institutional conditions, the developmental stage, and the policy regulations among the members of the BRICS.

Financial development and government support are standardized composite indices that have been developed using Principal Component Analysis (PCA) and means are set to zero and the standard deviation is set to one. The index of financial development (min = -1.85; max = 2.41) is quite dispersed, which is in line with both developed financial systems (e.g., China) and rather underdeveloped financial market (e.g., India and South Africa in some years). In the same regard, the index of government support is quite heterogeneous (min =-2.03; max=1.96), which is an element of institutional quality, effectiveness of the regulatory environment, and state intervention in entrepreneurial ecosystems.

The mean of technological innovation, which is proxied by the indicators of patent, is 3.97 with a moderate dispersion (standard deviation = 1.21). It implies that although BRICS economies have gained more innovative capacity during the period of sampling, innovation intensity is still lopsided and may be held by a few countries and large companies. The economic growth is highly volatile and the average growth rate of 4.12 percent is within a wide range, that is, between -7.82 and 14.23 percent, covering instances of macroeconomic instability, world financial crises and recovery period.

Trade openness has a large standard deviation of (22.87) and a mean of 56.41 percent meaning that the extent to which the BRICS economies integrate into global markets differs significantly. A top figure of 133.40 percent highlights that there are very open trade regimes and the bottom figure indicates growth strategies that are more inward in some time periods. This high variation gives great empirical grounds to analyze trade openness as a major factor that should drive entrepreneurship in a face of common world shocks.

The control variables include unemployment which is on average 6.88 percent with significant dispersion implying that there is heterogeneous state of the labor market that can affect necessity-induced entrepreneurship. The Gini coefficient of income inequality is 41.62, which means that the level of inequality in the BRICS economies remains relatively high, which can limit the opportunities of accessing entrepreneurial opportunities by the non-negligible parts of the population.

All in all, the descriptive statistics indicate that there is significant cross-country and time-dependent variation in the dependent and explanatory variables indicating the suitability of using dynamic panel estimators that capture the heterogeneity in as well as cross-sectional dependence. The high sovereignty in terms of trade openness, financial development, innovation, and institutional quality also paves the way to the central point of the research which is aimed to find out which structural factors prevail in the entrepreneurial results of the BRICS economies in the background of common global shocks.

Table 2: Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
Entrepreneurship (ENT)	8.42	4.15	1.90	19.60
Financial Development (FD)	0.00	1.00	−1.85	2.41
Technological Innovation (TINN)	3.97	1.21	1.45	6.88
Economic Growth (EG)	4.12	3.26	−7.82	14.23
Government Support (GS)	0.00	1.00	−2.03	1.96
Trade Openness (TOP)	56.41	22.87	23.10	133.40
Unemployment (UNEMP)	6.88	3.14	2.10	13.40
Income Inequality (GINI)	41.62	6.53	31.20	57.10

Notes:
FD and GS are normalised composite indices, which are built through PCA.
ENT is gauged by Total Early-Stage Entrepreneurial Activity (TEA).
All the variables are averaged in five BRICS countries in 23 years.

4.2 Correlation Analysis

Table 3 estimates the pairwise correlation to entrepreneurship and the primary explanatory variables of the BRICS economies in the period 20012023. The correlation matrix has two primary functions: (i) the presentation of initial evidence on the direction and strength of variables relationships, and (ii) the determination of the possibility of multicollinearity before the process of multivariate estimation.

In general, the magnitudes of the correlations are moderate and none of them is greater than traditional values that are linked to severe multicollinearity (usually 0.70 or more). This implies that the variables reflect similar but different aspects of the entrepreneurship environment and can be both incorporated into the regression models without the coefficients becoming unsustainable.

Financial development (FD) and government support (GS) have a positive correlation with entrepreneurship (ENT) (ρ=0.32 and ρ=0.14, respectively), meaning that more developed financial systems with stronger institutional support structures are, at the bivariate level, associated with greater entrepreneurship. Nevertheless, these correlations are moderate, which preannounces the fact that such effects could become weak as soon as heterogeneity and common shocks around the world are taken into account in the dynamic structure.

The technological innovation (TINN), on the other hand, shows negative relationship with entrepreneurship (ρ = -0.28). This initial indicator is in line with the hypothesis that innovation in BRICS economies can also be focused in capital-intensive or incumbent-dominated industries, which could increase barriers to new entrants into their operations instead of creating generalized entrepreneurship.

Economic growth (EG) is weakly negatively related to entrepreneurship (ρ = -0.19), implying that better growth is not an imperative condition of increased entrepreneurship on the aggregate level. This trend is consistent with the hypothesis that development in emerging economies might be fueled by dominant companies, government-industrial investment or commodity cycles as opposed to entrepreneurial activity.

Among all the explanatory variables, trade openness (TOP) has the most positive association with entrepreneurship (ρ=0.45). This gives preliminary empirical evidence to the main thesis of the paper: that opening up of economies to the global economy, exposure to international competition, and involvement into global value chains are directly associated with entrepreneurial undertaking in the BRICS economies. Although a correlation is not a causal relationship, this high association encourages the next emphasis on trade openness as a prevailing power of entrepreneurship during common shocks in the world.

The other independent variables, financial development, technological innovation, economic growth, and government support, have moderate correlation with one another, as financial system, innovation capacity, and institutional quality among emerging economies are related to others. Notably, all these non-point Correlations are not high enough to reveal redundancy, which also reasons the inclusion of all of them in the econometric models.

Overall, the correlation analysis learns two important lessons. To begin with, there are no overly high pairwise correlations which means that multicollinearity is not likely to distort the regression estimates. Second, the fairly robust relationship between trade openness and entrepreneurship provides initial support with the main hypothesis of the study, which is performed rigorously in both dynamic CS-ARDL and DCCE-MG estimations that considerably take into consideration cross-sectional dependence and endogeneity.

Table 3: Pairwise Correlation Matrix

Variable	ENT	FD	TINN	EG	GS	TOP
ENT	1.00					
FD	0.32	1.00				
TINN	−0.28	0.41	1.00			
EG	−0.19	0.36	0.29	1.00		
GS	0.14	0.53	0.47	0.44	1.00	
TOP	0.45	0.22	0.19	0.31	0.27	1.00

Notes:

The correlations between them are reasonable and theoretical.

The close relation between TOP and ENT gives the initial support of the main hypothesis.

4.2 Dynamic Common Correlated Effects Mean Group Results (Direct Effects)

Table 4 shows the findings of the Dynamic Common Correlated Effects Mean Group (DCCE-MG) estimator that tests the direct impacts of financial development, technological innovation, economic growth, government support, and control variables in entrepreneurship in the BRICS economies of 2001 - 2023. It is a very specific estimator, as it takes into consideration cross-sectional dependence, common global shocks that cannot be observed, and slope heterogeneity, thus especially appropriate to macro-panel analysis of large emerging economies.

The results demonstrate a compelling and policy-related trend. Once the global shocks and the heterogeneous country responses are mentioned, trade openness (TOP) is the only statistically significant variable with an effect on the entrepreneurship. The trade openness coefficient is positive and significant, at the 5% level (β = 0.151, p = 0.029) which means that more integration into the global markets strongly encourages entrepreneurship in the BRICS

economies. This result is an indication that foreign demand, competitive pressures, and global value chains are more decisive factors in the process of entrepreneurship compared to domestic macroeconomic fundamentals when the common shocks are held constant.

Financial development (FD), on the other hand, has a negative but insignificant coefficient (β= -27.097, p=0.303). The implication of this finding is that greater financial systems do not necessarily lead to greater entrepreneurial activity in the BRICS context, when global determinants and cross-country heterogeneity are held constant. This observation is aligned with the perception that available financial resources in the emerging economies might be skewed towards the allocation to large firms, state-owned firms or politically inclined actors which cannot be effective in supporting entrepreneurship at the early stages.

The same can be stated about technological innovation (TINN) whereby it does not have a statistically significant impact on entrepreneurship (β = -1.375, p=0.843). This implies that the innovation activity within the BRICS economies can be capital based, incumbent based or, a weakly diffused innovation to new entrepreneurial ventures. Instead of decreasing barriers to entry, innovation can also strengthen and increase the cost of entry into the market.

The economic growth shows negative and insignificant (β = −14.103, p = 0.219) which means that the high growth rates do not contribute to the development of entrepreneurship in a systematic manner where the dynamic adjustment and global shocks are considered. This result conflicts with the traditional belief that economic growth inevitably creates entrepreneurial opportunities in new economies and brings out the difference between growth that comes about by high-scale investment and the nature that comes about by entrepreneurial dynamism.

The government support (GS) coefficient is negative and not statistically significant (β = -1.274, p=0.377), which implies that the institutional support alone does not directly stimulate the entrepreneurship of the BRICS economies. The outcome supports the thesis that governmental support is more of a conditioning/moderating variable than, in itself, a driver of entrepreneurial activity- another question that is considered in the moderation analysis.

Other control variables, such as unemployment (UNEMP) and income inequality (GINI) do not affect the entrepreneurship directly and robustly, which means that both the labor market slack and the distributional conditions do not have a direct and significant impact on entrepreneurship when global shocks are held constant through the model.

Diagnostically, the model is an effective one. The group R^2 of 0.61 is quite large, indicating that the explanatory power of the variables is quite large and that unobserved global phenomena, including financial crises, commodity price cycles, international policy shifts, and others are properly controlled. The statistically significant cross-sectional dependence test (p = 0.017) also confirms the use of the DCCE-MG estimator as opposed to the traditional panel models.

On the whole, the findings in Table 4 are solid empirical evidence of the main hypothesis of this paper: in circumstances of shared global shocks, trade openness prevails over domestic financial, technological and growth fundamentals, as a factor of entrepreneurship in the BRICS economies. Such an observation is a driving force towards a policy change of entrepreneurship that does not focus on national levers but incorporates policies that do reinforce global market integration and competitiveness at the external.

Table 4. Dynamic Common Correlated Effects Mean Group Estimates (Direct Effects)
Dependent variable: Entrepreneurship (ENT)
Estimator: DCCE-MG
Sample: BRICS, 2001–2023

Variable	Coefficient	Std. Error	z-stat	p-value
Financial Development (FD)	−27.097	26.288	−1.03	0.303
Technological Innovation (TINN)	−1.375	6.927	−0.20	0.843
Economic Growth (EG)	−14.103	11.467	−1.23	0.219
Government Support (GS)	−1.274	1.441	−0.88	0.377
Trade Openness (TOP)	**0.151**	**0.069**	**2.18**	**0.029**
Unemployment (UNEMP)	−0.618	0.578	−1.07	0.285
Income Inequality (GINI)	−0.178	0.318	−0.56	0.575

Model diagnostics

Statistic	Value
R^2 (MG)	0.61
Root MSE	1.98
Cross-sectional dependence p-value	0.017
Cross-sectional averages	Included
Slope heterogeneity	Allowed

Notes:

- Robust standard errors reported.
- Only trade openness remains statistically significant after controlling for global shocks.

4.3 Long-Run Cointegration Results: FMOLS Robustness Analysis

The estimation of the long-run cointegration is presented in Table 4, which was done using the Panel Fully Modified Ordinary Least Squares (FMOLS) estimator of the BRICS economies between the year 2001 and 2023. FMOLS is utilized to do a robustness test to the dynamic DCCE-MG findings since it corrects the two summary effects of serial correlation and possible endogeneity of cointegrated panels and explicitly tests the long-run equilibrium relationships. The findings indicate that numerous key long-run trends depict differences with but at the same time enhance the short- and medium-run dynamics determined in the DCCE-MG model.

Financial Development

There is a long-run negative and significantly significant effect of financial development on entrepreneurship ($\beta = -11.210$, $p < 0.01$). This observation implies that in the long-term, more profound financial systems within the BRICS economies are not likely to encourage entrepreneurial activity. Rather, there is a possibility of more and more financial development giving preference to large, capital-intensive, or politically connected firms, and limiting access to finance by small and new entrepreneurs. Such an outcome is in line with the financial

capture and market concentration theory in emerging economies and it assists in understanding the explanation why financial development becomes irrelevant in the dynamic DCCE-MG estimations after the control of global shocks and heterogeneity.

Technological Innovation

It is also found that entrepreneurship is negatively related to technological innovation with a statistically significant long-run relation ($\beta = -1.370$, $p < 0.01$). This finding suggests innovation-focused development in the BRICS environment can be taken over by existing firms and state-driven projects, increasing the costs of entry, but not the formation of a new firm. In the long run, it seems that innovation becomes more and more intensive in terms of capital and knowledge and only small entrepreneurial activities can be spread. This effect of innovation that is exclusionary in long-run is compatible with the unimportant or even negative coefficients of innovation in the dynamic models.

Economic Growth

Conversely, the impact of economic growth on entrepreneurship is very positive and significantly huge in long-term ($\beta = 12.560$, $p < 0.01$). It means that the long-term macroeconomic rise brings about the demand side opportunities, enhances the market conditions and slowly promotes the entrepreneurial activity in the long run. Notably, this observation explains why the earlier dynamic outcomes have been the case as it demonstrates that growth does have an impact on entrepreneurship, but it is a structural, rather than a short-run or immediate, driver.

Government Support

The coefficient of support by the government is positive and statistically significant ($\beta = 0.320$, $p < 0.05$) therefore, indicating that the entrepreneurial environment is better with time due to the improvement in the quality of institutions, effectiveness of the regulatory environment, and mechanisms of public support. Although the dynamic DCCE-MG estimations are not sensitive to the government support, the FMOLS findings suggest that its impact becomes actualized over time, which supports the view that government support should be regarded as long-term institutional facilitator, but not short-term stimulus.

Trade Openness

Entrepreneurship is positively correlated with trade openness in the long-term ($\beta = 0.050$, $p < 0.05$), as it was revealed in the main of the research. The coefficient, though not as large as it is in the dynamic model, is statistically significant, which highlights the long-run presence of international market integration in promoting entrepreneurial activity. This fact supports the conclusion that trade openness is a short-run and long-run entrepreneurial driver in the BRICS economies.

Control Variables

Unemployment is one of the control variables that has a positive and significant long-run impact ($\beta = 1.020$, $p < 0.01$), and this concludes the necessity-based entrepreneurship hypothesis, in which a lack of wage employment opportunities compels individuals to self-employment. On the other hand, the impact of income inequality is negative and significant ($\beta = -0.290$, $p < 0.01$) which means that unequal income distribution prevents the entrepreneurial participation by restricting access to resources, networks, and opportunities.

Synthesis with Dynamic Results

Combined, the FMOLS results will be able to fill the gaps left by the DCCE-MG outcomes as it indicated a very distinct temporal difference in the process of entrepreneurship. Though dynamic estimates reveal that trade openness prevails over entrepreneurship in common global shocks, the FMOLS findings reveal that the economic growth and government support are significant in the long-run, but financial development and technological innovation could have structurally exclusionary influences in the long-run. This two-sided picture demonstrates the significance of the dynamism and long-run estimators in the study of entrepreneurship in developing economies.

Table 5. Long-Run Cointegration Estimates (FMOLS Robustness)

Dependent variable: Entrepreneurship (ENT)
Estimator: Panel FMOLS
Countries: BRICS (N = 5)
Period: 2001–2023

Variable	Coefficient	t-statistic
Financial Development (FD)	−11.210***	−6.42
Technological Innovation (TINN)	−1.370***	−5.26
Economic Growth (EG)	12.560***	9.71
Government Support (GS)	0.320**	2.48
Trade Openness (TOP)	**0.050***	**5.98**
Unemployment (UNEMP)	1.020***	15.41
Income Inequality (GINI)	−0.290***	−3.26

Notes:
*** p < 0.01, ** p < 0.05
FMOLS corrects for serial correlation and endogeneity.

4.4 Synthesis of Results Across Estimators

Table 6 arithmetically summarizes the results of the estimated effects of the main explanatory variables on entrepreneurship in three econometric models: the static panel models, the Dynamic Common Correlated Effects Mean Group (DCCE-MG) estimator, and the Panel FMOLS long-run cointegration estimator. This comparative generalization is essential in gauging the strength, steadiness and time applicability of the empirical evidence.

Financial Development

The inconsistent effects of financial development have non-entrepreneurial end effects among estimators. In the less rigorous models, there is a positive relationship but this is lost and its connection becomes negative with the more rigorous frameworks. The coefficient in DCCE-MG estimator is found to be statistically insignificant when controlling common global shocks and cross-sectional dependence. Conversely, the FMOLS estimates show that the negative long-run effect is strong and statistically significant which suggests that more intense financial structures in the BRICS economies are becoming more favorable toward existing firms and capital-intensive operations at the expense of new entrepreneurial entry. This trend proves that the positive dynamics which can be observed in the models on the surface are probably triggered by missing world factors and the aggregation bias.

Technological Innovation

There is a poor and fluctuating relationship between technological innovation and entrepreneurship among models. Though there are mixed signs of the static estimations, the innovation is statistically nonsignificant in the DCCE-MG framework and negative and significantly high in the long-run FMOLS estimates. This observation implies that innovation within the BRICS economies does not spread out uniformly within the entrepreneurial sector and may actually increase barriers to entry in the long run. The difference between short-run insignificance and long-run negativity is an important indication of the existence of an innovation- commercialization gap in which technological advancement is not being converted into entrepreneurial practices.

Economic Growth

The impact of economic growth is significantly different with estimators. The results of the application of the static models are mixed, whereas the concept of growth becomes irrelevant in the DCCE-MG specification that is dynamic. Nonetheless, in the FMOLS system, the economic growth turns out to be a powerful and constructive long-run determinant of entrepreneurship. This trend shows that growth is not a one-time booster of entrepreneurial activity but a slow-acting but steady driver of the process through market expansions, higher incomes, and longer-term demand-side opportunities. These findings thus suggest a growth-entrepreneurship relationship in the long-run and not in the short-term or contemporarily.

Government Support

Support of the government is not statistically significant in both the static and dynamic estimations. However, it is positive and significant in the long-run FMOLS outcome, which suggests that institutional quality and public supporting mechanisms have a significant impact on the outcomes partly through cumulative and structural pathways. This supports the speculation that government support is a sluggish institutional facilitator, the entrepreneurial effects of which are realized through the course of time and not through instantaneous policy shocks.

Trade Openness

The strongest and most consistent determinant of entrepreneurship is trade openness. It is good and statistically significant in the non-dynamics model and it is significant in the DCCE-MG estimator with the control of the global shocks and heterogeneity and it still has an effect in the FMOLS long-run estimates. This uniformity between estimators and time horizons highlights the primary role of international market integration in encouraging the entrepreneurial activity in the BRICS economies. It seems that trade openness can work in various ways, such as expansion of the marketplace, competitive intensity, and knowledge dispersion, which explains its resistance to both the global shocks and structural changes.

Overall Interpretation

The analysis in Table 6 shows that there are definite priorities of entrepreneurial drivers in the BRICS economies. The variables, traditionally stressed in the development theory, like financial development and technological innovation, become irrelevant to explanations or even negative impacts when methodological rigor is elevated. In comparison, the only variable that encourages entrepreneurship in both the long run, dynamic, and the static model is trade openness.

Table 6. Summary of Core Findings across Estimators

Variable	Static Models	DCCE-MG	FMOLS
Financial Development	+	– (ns)	–***
Technological Innovation	±	– (ns)	–***
Economic Growth	– / +	– (ns)	+***
Government Support	ns	ns	+**
Trade Openness	**+**	**+**	+*

Key insight: Trade openness is the only variable consistently positive and significant across all estimators.

5. Conclusion

By specifically considering global shocks and cross-sectional dependence as well heterogeneity and dynamic persistence aspects- more and more of the central aspects of macro-entrepreneurship analysis in a globally connected economy- this study aimed to revisit the determinants of entrepreneurship in BRICS economies. The study offers strong evidence supporting the role of trade openness in dominating the outcomes of entrepreneurship in BRICS when global shocks are removed, and the influence of financial development, technological innovation and economic growth turn weak, volatile and insignificant using second-generation panel methods, especially the Dynamic Common Correlated Effects Mean Group (DCCE-MG) estimator.

Three fundamental conclusions can be made.

To begin with, entrepreneurship in BRICS is structurally and dynamically inertial, responding slowly to change and not instantly to the fluctuation in the macroeconomic environment. This confirms the application of dynamic estimators and warns against the application of the captured estimates without regard to the processes of adjustments and global spillovers.

Second, entrepreneurial growth cannot be explained by financial development and technological innovation, after the common shocks have been factored in. This result contradicts traditional policy discourses that confound financial deepening or the strength of innovation with entrepreneurial dynamism in emerging markets. Rather, it points to the existence of distributional and institutional bottlenecks, according to which finance and innovation are disproportionately appropriated by large incumbents, state-connected firms or capital-intensive industries, restricting access by new and small firms.

Third, and to an extent the strongest and the most consistent driver of entrepreneurship in all of the dynamic specifications turns out to be trade openness. This points to the fact that the access to international markets, exposure to competition, involvement in global value chains, and diffusion of knowledge with trade are the most productive mediums of entrepreneurial opportunity creation in large emerging economies. More importantly, this is maintained even with a significant cross-sectional dependence, and it indicates the robustness of trade-led entrepreneurship during global shocks.

Combined, the results reframe entrepreneurship in BRICS as an externally predetermined process, which is less driven by accumulating factors locally and more by the capacity of companies and individuals to get linked to the international markets.

6. Policy Recommendations

The results of this paper indicate that the entrepreneurship in the BRICS economies is motivated not so much by the financial and technological growth within the country but the integration with the external markets. The openness to trade comes as the sole determinant which is always positive and also statistically significant among the estimates of statical, dynamic, and the long-run, highlighting the fact that it is significant in the development of entrepreneurs in a normal global shock.

First, the entrepreneurship policy must be clearly coordinated with the trade and export policies. Governments ought to open the entry points of small and young companies in foreign markets by improving their custom processes, by providing export credit, by digitalizing trade, and by providing export-promotion programs. The increase in the role of SMEs in global and regional value chains can generate demand-related incentives that will encourage firms to enter the market.

Second, the financial development policies should shift away past aggregate deepening towards inclusiveness. The adverse or inconsiderable impacts of financial development show that credit growth is not beneficial to the entrepreneurs. The policymakers ought to focus on venture capital, credit guarantees, and other financing tools that specifically target start-ups and start-up firms.

Third, the innovation policy must be restructured to facilitate the diffusion of entrepreneurship instead of technological accumulation by the incumbent. The low correlation between innovation and the entrepreneurship poses that start-up-focused innovation grant, commercialization assistance, and streamlined intellectual property regimes are necessary to reduce entry barriers to the new companies.

Fourth, economic growth ought to be considered a long-run facilitator, rather than a demand inducement, of entrepreneurship. The targeted entrepreneurship policies should be added to growth strategies, and the emphasis of the expansion should be made on creating new business, not concentrating in capital-intensive sectors.

Last but not least, institutional reforms must be made with an express entrepreneurial orientation. Although government support is important in the long term, it should be effective in terms of alleviating regulatory burden, predictability of policies, and should be made to favor new and small firms as opposed to incumbents.

On the whole, the data indicate that there can be a strong policy priority in order to develop entrepreneurship in the BRICS economies: it has to be an outward-oriented policy, which is attached to trade-linked policies along with the inclusive finance, the diffusion of innovation, and the entrepreneurship-sensitive institutions.

7. Directions for Future Research

This study can be expanded in a number of ways in future research. First, opportunity- and necessity-driven entrepreneurship might be differentiated at the micro-level or firm-level that might react differently to trade openness and institutional factors. Second, nonlinear and threshold models may investigate other possibilities of financial development, innovation, and economic growth to become entrepreneurship-promoting only after some institutional or developmental threshold. Third, it is important that future research needs to explicitly model global shock transmission channels including global value chains, commodity price

cycles, and financial contagion in order to gain a clearer insight into how trade openness prevails over domestic fundamentals. Fourth, the division of the government assistance into regulatory quality, state intervention, and innovation policy would help to understand what institutional elements can enable entrepreneurial diffusion. Lastly, a further extension of the analysis to other emerging or developing country groups would be useful to determine the generalizability of the BRICS specific results and to further test the causation between entrepreneurship and economic growth through a two-way correlation.

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