Entrepreneurship and Economic Growth Nexus: Econometric evidence from BRICS Countries

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Summary:

The purpose of this paper is to investigate the impact of entrepreneurship on economic growth, with GDP per worker as the dependent variable, and entrepreneurship as measured by the Global Entrepreneurship Index (GEI), Business Freedom (BUSfr), and Starting a Business (STRbus) as independent variables, as well as other macroeconomic control variables (Gross capital formation, Index of Economic Freedom, Trade openness, Human Development Index, and Government Expenditure). The data set includes BRICS countries (Brazil, Russia, India, China, and South Africa) from 2004 to 2020. The estimate findings of the fixed effects panel data model of the five BRICS countries utilizing (Driscoll & Kraay, 1998) standard errors approach revealed a significantly positive influence of Business Freedom (BUSfr) and Starting a Business (STRbus) on economic growth; and an insignificantly impact of Global Entrepreneurship Index (GEI).

Keywords: BRICS; Driscoll & Kraay; Economic Growth; Entrepreneurship; Panel Data.

Jel Classification Codes : C23, F43, L26.

I- Introduction :

Entrepreneurship is recognized as a fundamental tool or conduit for economic growth; it is critical to development and a major solution to a variety of economic, social, and environmental problems. Entrepreneurship, with all of its risks of profit, is a major growth driver for the economy, as is the capacity to start, organize, and manage a commercial venture. The major feature of the twenty-first century is that the global picture is more complex than the usual divide between developed and developing countries implies. Some economies are growing more rapidly than others, with millions of people joining the middle class. The entrepreneurial capability of a country is strongly related to the country's competitiveness and economy, displaying representativeness and relevance. However, various things can impact this potential, including a country's culture, laws and bureaucracy, politics, and a variety of other possibilities. When comparing developed and emerging nations, it is clear that there is a variation in the scenarios to be conducted; that is, the beginning point for entrepreneurship has numerous peculiarities (Silva, Cavalcanti, & Rodrigues, 2021).

The BRIC group (Brazil, Russia, India, and China) has been drawing attention among this group of emerging countries since the turn of the century, and their governments agreed to join a political organization (together with South Africa) known as BRICS. Because they were in the vanguards of emerging countries and speedy global growth, the BRICS countries had no substantial economic hurdles before or during the 2008/2009 US housing and global financial crises. According to the World Economic Outlook forecasts, the average yearly growth rates and the total investment in the BRICS countries were greater than in the G7 countries combined (Coulibaly, Erbao, & Mekongcho, 2017). The BRICS countries make a significant economic contribution to the global market. Because of increased entrepreneurial activity in BRICS countries, the total gross domestic product (GDP) of BRICS economies is around 46 percent of global GDP, and it is expanding. Furthermore, the governments of all BRICS nations strive to increase entrepreneurial activity in order to foster innovation and inclusive growth (Rani & Kumar, 2021).

Entrepreneurship is critical for the formation of new businesses, the production of private-sector jobs, and the generation of genuine wealth. The public sector is a key employer in many developing and emerging economies, and public sector employment is typically a drag on economic growth since scarce government resources must be dedicated to wages rather than other expenditures such as infrastructure and education. As a result, entrepreneurial policy will boost private sector development and give productive alternatives to public sector employment in the BRICS; hence, for further knowledge we pose the interesting question:

How far does Entrepreneurship influence Economic Growth in the BRICS countries?

In order to address the issue, the following hypotheses can be relied upon:

- Global Entrepreneurship Index has a positive statistically significant, but not strong, impact on economic growth in BRICS.
- Business Freedom has not a statistically significant impact on economic growth in BRICS.
- Starting a Business has a positive statistically significant impact on economic growth in BRICS.

Existing literature indicates that the conceptualization of entrepreneurship is undefined and multidimensional. Entrepreneurship must be decomposed in order to be investigated for its function in determining economic growth. Accordingly, this research depends on three main dimensions of entrepreneurship (Global Entrepreneurship Index, Business Freedom, and Starting a Business) and their relationship to economic growth in the context of the five BRICS countries. These entrepreneurial variables were chosen based on the availability of data for each BRICS country. The

present study also included a set of metrics that measure economic growth as well as its essential macroeconomic causes.

The main objective of this research is to look at the function and impacts of entrepreneurship as a driver of economic growth. The notion that entrepreneurship and economic growth are inextricably connected and sustain positive ties stems from Schumpeter's work. More entrepreneurs would result in more economic growth. The consequence would be the tangible manifestation of the entrepreneur's traits, notably his proclivity to create. The research examines the factors behind the BRICS entrepreneurial revival, as well as the linkages between entrepreneurial activity and economic growth.

The rest of this work is structured as follows: Section "I.1. Theoretical and empirical literature" explains different strands in evaluating the relationship between economic growth and entrepreneurial activities; it also defines the theoretical underpinnings of entrepreneurship; Section " II– Methods and Materials " describes the variables and their sources, estimation strategy, and econometric methodology used; Section " III- Results and discussion " explain the findings in terms of descriptive statistics, statistical tests, and estimation results, and finally Section " IV- Conclusion " begin with arguments and further information, to reach an essential summary including policy implications derived from the empirical results.

I.1. Theoretical and empirical literature

The relationship between entrepreneurship and economic growth has preoccupied economists since it was recognized, following the inability of endogenous models to explain the residue, that human action would be at the origin of economic growth. On a theoretical level, two approaches have provided arguments clarifying this relationship: the Schumpeterian approach and the Neo-Austrian approach which is based on the work of (Kirzner, 1973).

In his classic treatise, "*Theorie der wirtschaftlichen Entwicklungen* (Theory of Economic Development)", (Schumpeter, 1931) proposed that entrepreneurs starting new businesses provided the engine for economic growth, Even in his 1942 classic, "Capitalism, socialism and Democracy", he saw that progress itself can be "mechanized" just as well as managing a stationary economy and this mechanization of progress is likely to affect individual initiative (entrepreneurship) and capitalist society almost as much as stopping economic progress. To demonstrate this, it suffices to note, firstly, what constitutes the function of entrepreneur and, secondly, what it means for bourgeois society and from the point of view of the survival of the capitalist regime, Schumpeter said: « The role of businessmen is to restructure or revolutionize the production pattern by exploring an invention, or more generally, an untried technological possibility for producing a new commodity or producing an old one in a new way… To undertake such new things is difficult and constitutes a distinct economic function, first because they are beyond the routine tasks that everyone understands, and second because the environment in many respects is resistant.

It should be noted that the Schumpeterian approach emphasizes the innovative entrepreneur, which suggests that it excludes from its field the self-employed without innovative vocation; while this type of so-called necessity entrepreneurship should not be overlooked as it is booming in developing countries, some of which are experiencing fairly high growth rates. The New Austrian approach to entrepreneurship, of which (Kirzner, 1973) is the main representative, focuses on the role of the entrepreneur in balancing the markets. According to (Kirzner, 1973), the entrepreneur is an individual who sees opportunities for profit that others do not see and who uses an arbitrator to change the market balance in order to make a profit (Nzaou, 2015). (Sternberg & Wennekers, 2005) show that the relationship between entrepreneurship and economic growth is difficult to grasp since different types and different phases entrepreneurship influence economic growth. Also, the relationship is bidirectional in the sense that entrepreneurship encourages economic growth which

in turn can affect the arbitration of individuals between different professional occupations including entrepreneurship.

(Baumol, 1990) in his study, "« entrepreneurship: Productive, unproductive and destructive »", distinguished between many forms of entrepreneurship. Baumol mentions that entrepreneurs are individuals who are clever and inventive to find means to increase their wealth, strength and reputation, and he contends that it is to be anticipated that not all of them will be deeply concerned as to whether the activity that accomplishes these objectives adds much or little to the social product or, in that respect, whether it is a real obstacle to production. Baumol focused on «Schumpeterian innovative entrepreneurs » that coexist with « defensive and necessity entrepreneurs », the latter are those who join a new business, not because of market opportunities and creative ideas, but just because they need revenue to survive, for obvious reason, this kind of « survival –driven » self-employed is particularly diffused in the developing countries.

In his research:" « entrepreneurship and economic growth: an empirical analysis »" (Salgado-Banda, 2005) is proposing a new variable to proxy for productive entrepreneurship based on patent data. Self-employment data is used as an alternative representative. In particular, he studies the impact of entrepreneurship on economic growth through the use of these two measures. The research examines 22 OECD countries and discovers a significant relationship between the selected measure of productive entrepreneurship – the degree of innovation of different countries – and economic growth, while the alternative measure, due to self-employment, appears to be negatively correlated with economic growth.

In her thesis titled: "« The role of entrepreneurship as the driver of economic growth »", (Ogunlana, 2018) tries to examine the impacts of entrepreneurship on economic growth, also, analyses challenges faced by business start-up or small and medium enterprises. The study found that entrepreneurship can play an important role in accomplishing economic growth in a country that overcomes its economic crisis, generates employment, innovations, increases production and diversifies the revenue stream of the economy while encouraging the development of small and medium-sized enterprises.

In their study « Institutional factors, opportunity entrepreneurship and economic growth: panel data Evidence », (Aparicio, Urbano , & Audretsch, 2016) explore the institutional factors that encourage opportunity entrepreneurship in order to achieve higher rates of economic growth, They suggest that institutional factors which affect productive behavior, such as entrepreneurship, are not automatically affected as it is usually assumed in models of endogenous growth, rather than as a means of conducting institutions in society. Thus, entrepreneurship opportunities are identified as one mechanism which affects economic growth. Using a three-stage, least-square method using unbalanced panel data from 43 countries (2004-2012), informal institutions have a higher impact on opportunities for entrepreneurship than formal institutions. Variables such as corruption control, faith in one's ability and private publicity to gain credit encourage the beneficial impact of entrepreneurship opportunities

In his paper « Entrepreneurship, Innovation & Economic Growth: An Empirical Study of Developed & Developing Countries », (Cao, 2018) examined the relationship between entrepreneurship, innovation and economic growth using real GDP per capita, R&D investment per capita and new business density to measure growth, innovation and entrepreneurship respectively. The data consists of 125 countries including developed and developing countries for the period 2006 – 2016. He employed two estimation methods which are Static Panel Data Method and Generalized Method of Moments (GMM) to carry out the work. The results suggest that in short-term, the impact of innovation and entrepreneurship on growth is not significant or even have negative significance in developing countries. But the losses in short-term will be compensated in long-term since they show a positive and significant correlation in both groups of countries.

In their article «Economic globalization, entrepreneurship, and development» (Coulibaly, Erbao, & Mekongcho, 2017) Using an unbalanced panel dataset for BRICS member states, they investigated these propositions by estimating the effects of: a comprehensive globalization index variable (KOF) and an opportunity total entrepreneurship activity (OTEA) variable through an Arellano-Bond model estimator first, then a dynamic estimation model next. Results show, after utilizing both estimation techniques, the variables were all positive and statistically significant, hence confirming the hypothesis. We posit the implementation of innovation-driven policies that will promote the movement of production factors, enhance South-South financial and regional trade agreements and sustain economic development in developing nations in general and BRICS economies in particular.

II– Methods and Materials:

The present study investigated to test how different types of entrepreneurships impact the economy growth in the five BRICS countries (Brazil, Russia, India, China, and South Africa). The paper analyzed a collection of metrics evaluating economic growth, entrepreneurial activity, and macroeconomic circumstances for each country.

In this study, the dependent variable is GDP per worker, which is one of the most accurate indicators of economic growth. Entrepreneurial activity at the country level, as measured by the Global Entrepreneurship Index (GEI), Business Freedom (BUSfr), and Starting a Business (STRbus) are the primary explanatory variables.

The study incorporated many control variables in the econometric model, in addition to the variables indicated above. The control variables are various factors suggested by the economic growth theories that would affect economic growth: the investment ratio (proxied by gross capital formation), knowledge (measured by the Human Development Index), the Index of Economic Freedom (ECFR), trade openness (TRDop), and government expenditure (GOVexp)In Table 1, we describe the dependent and independent variables used in this study, including their definition and sources.

Table (1): Description of the variables considered in the analysis

Variable	Definition	Source
Dependent Variable		
Labor productivity (GDP per worker-GDPpw)	The total volume of output (measured in terms of Gross Domestic Product, GDP) produced per unit of labor (measured in terms of the number of employed persons or hours worked). Data are in constant 2010 U.S. dollars	International Labor Organization ILOSTAT
Independent variables		
The Global Entrepreneurship Index (GEI)	Annual index that measures the health of the entrepreneurship ecosystems. The index methodology collects data on the entrepreneurial attitudes, abilities, and aspirations of the local population and then weights these against the prevailing social and economic 'infrastructure' – this includes aspects such as broadband connectivity and the transport links to external markets.	The Global Entrepreneurship and Development Institute
Business Freedom (BUSfr)	For and country, the score for business freedom is a number between 0 and 100, with 100 representing the most open business climate. The quantitative score is extracted from a set of variables that influence the ease of beginning, running, and closing a business.	The Heritage Foundation

Starting a Business (STRbus)	The STRbus Indicator tests the amount of processes, time, expense and minimum capital specifications required for the start-up and structured establishment of a small to medium-sized limited liability corporation in the largest business city of each economy.	The World Bank Group's Global Indicators Group
Gross capital formation (GCF)	Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Data are in constant 2010 U.S. dollars.	World Bank
The Index of Economic Freedom (ECFR)	The Index of Economic Freedom focuses on four key aspects of the economic environment over which governments typically exercise policy control: Rule of law, Government size, Regulatory efficiency, and Market openness.	The Heritage Foundation
Trade openness (TRDop)	The sum of exports and imports of goods and services measured in US dollars at current prices in millions.	UNCTADstat
Human Development Index (HDI)	A composite index measuring average achievement in three basic dimensions of human development—a long and healthy life, knowledge and a decent standard of living.	Human Development Reports-UNDP
government expenditure (GOVexp)	General government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees).	World Bank

Source: authors' elaboration

The relationship between entrepreneurship and economic growth has been widely explored (Acs, Audretsch, Braunerhjelm, & Carlsson, 2012) ; (Audretsch, & Keilbach,, 2008) ; (Acs, Estrin, Mickiewicz, & Szerb, 2018) ; (Noseleit, 2013). Nonetheless, to specify the sequence of the institutional environment, entrepreneurship, and economic growth, an augmented production function that includes an explicit measure of entrepreneurship is estimated. On this basis, we can use the form Cobb – Douglas function to measure the impact of entrepreneurship on economic growth:

$$Y_{it} = \alpha BUSfr_{it}^{\beta_1} GEI_{it}^{\beta_2} STRbus_{it}^{\beta_3} GCF_{it}^{\beta_4} TRDop_{it}^{\beta_5} HDI_{it}^{\beta_6} GOVexp_{it}^{\beta_7} ECFR_{it}^{\beta_8} L_{it}^{\beta_9} \quad (01)$$

Our endogenous growth model follows Romer's assumption (Romer, 1986) regarding the labour coefficient (β_9) settled in one. To some point, this ensures that externalities are not internalized, perception is created (and articulated by entrepreneurship), and the use of resources is ignored. Taking into consideration this, dividing output by labour in order to guarantee a function with constant returns to scale, and introducing lags on the right-hand side, we obtain our economic growth equation to estimate:

$$\frac{Y_{it}}{L_{it}} = \alpha BUSfr_{it}^{\beta_1} GEI_{it}^{\beta_2} STRbus_{it}^{\beta_3} GCF_{it}^{\beta_4} TRDop_{it}^{\beta_5} HDI_{it}^{\beta_6} GOVexp_{it}^{\beta_7} ECFR_{it}^{\beta_8} \quad (02)$$

where Y_{it} is the economic output of country i at time t, measured as the GDP, Lit represents the total labour force (hence Y_{it}/L_{it} is labour productivity, a proxy for economic growth), $BUSfr$, GEI, and $STRbus$ represent the endowment of entrepreneurial activity, GCF is country i's endowment of capital, $TRDop$ is the openness trade, HDI is The Human Development Index, $GOVexp$ is the government consumption, and $ECFR$ is The Index of Economic Freedom in each country. Thus, this formally specifies that entrepreneurship contributes to the economic growth of countries. Following the appendix of (Acs, Audretsch, Braunerhjelm, & Carlsson, 2012) to linearize the production function, we use the natural logarithm in the dependent and independent variables in our growth model. According to (Wooldridge, 2013), Models using the logarithm on both sides (dependent and independent variables) cause their coefficients to be explicitly represented in terms of the

percentage change in the independent variable, which implies a difference in the dependent variable represented by the coefficient concerned.

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$$\ln GDPpw_{it} = \alpha + \beta_1 \ln GEI_{it} + \beta_2 \ln BUSfr_{it} + \beta_3 \ln STRbus_{it} + \beta_4 \ln GCF_{it} + \beta_5 \ln ECFR_{it} + \beta_6 \ln TRDop_{it} + \beta_7 \ln HDI_{it} + \beta_7 \ln GOVexp_{it} + \tau_t + \eta_i + \varepsilon_{it} \quad (03)$$

The impact of different types of entrepreneurial activity on economic growth is empirically investigated in this study utilizing panel data spanning the five BRICS nations from 2004 to 2020.The selected empirical strategy is subject to theoretical considerations, dataset structure, and the potential econometric issues that need to be dealt with in this investigation. The use of panel data is the first remedy to address some the above-listed issues in the entrepreneurship-economic growth relationship. This study follows the previous research practice which suggests that static estimators, namely fixed effects (FE) and random effects (RE) are more commonly used in panel data analysis. The suitability of the two alternative estimators is assessed on theoretical basis, the relationship to be investigated, the type of the data (heterogeneity; unobserved effects) and on the diagnostics tests. Random effects (RE) estimator is preferred in situations where the unobserved country effects are assumed to be uncorrelated with the included regressors (Gujarati, 2004). In the other hand, the fixed effects (FE) estimator accounts for such correlation between the unobserved heterogeneity and explanatory variables in the model, within each cross-sectional observation, i.e., between countries. The FE rather than the RE is more frequently applied in the entrepreneurship-economic performance literature. Favouring the use of FE, (Wooldridge, 2013).

The study relies on Hausman test to confront the decision of which is the most appropriate estimator for this investigation (Hausman, 1978). The null hypothesis states that there are no systematic differences between the two estimators, i.e., that the RE model is valid. A rejection of the null hypothesis suggests that the fixed effects (FE) is preferred over the random effects (RE) (Baltagi B. , 2021).

Pesaran CD (cross-sectional dependence) test is used to test whether the residuals are correlated across entities. Cross-sectional dependence can lead to bias in tests results (also called contemporaneous correlation) (Pesaran, 2004).

Modified Wald statistic is used to test for groupwise heteroskedasticity in the residuals of a fixed effect regression model. The modified Wald statistic is workable when the assumption of normality is violated, at least in asymptotic terms (Greene, 2020).

A number of tests for serial error correlation in panel data models have been proposed in the literature. HR-test is used to test the first order serial correlation in fixed effect panel data models without gaps (Born & Breitung, 2016), (Wursten, 2018).

The vast majority of panel data growth studies use a fixed effect (within-group) estimator rather than a random effects estimator. The use of panel data methods to address unobserved heterogeneity can bring substantial gains in robustness, but is not without costs. The fixed-effects identification strategy cannot be applied in all contexts. Sometimes a variable of interest is measured at only one point in time. Even where variables are measured at more frequent intervals, some are highly persistent, in which case the within-country variation is unlikely to be informative. Given the potentially unattractive trade-off between robustness and efficiency, (Barro & Sala-i-Martin, 1997),

(Temple, 1999), and (Wacziarg, 2002) all argue that the use of fixed effects in empirical growth models has to be approached with care. The price of eliminating the misleading component of the between variation – namely, the variation due to unobserved heterogeneity – is that all the between variation is lost.

There are alternative ways to reveal this point, but consider the random effects GLS estimator of the slope parameters, which will be more efficient than the within-country estimator for small T when the random-effects assumptions are appropriate. This GLS estimator can be written as a matrix-weighted average of the within-country estimator and the between-country estimator, which is based on averaging the data over time and then estimating a simple cross-section regression by OLS (Durlauf, Johnson, & Temple, 2005). To address some the above empirical issues and to ensure econometric validity and statistical inference, (Hoechle, 2007) suggests using (Driscoll & Kraay, 1998) standard errors adjusted for unbalanced panel data. (Hoechle, 2007) argues that "*Driscoll-Kraay standard errors are well calibrated when the regression residuals are cross-sectionally dependent*".

III- Results and discussion :

Table 4. displays descriptive statistics of the variables that were included in the analysis. The descriptive statistics provide a summary of the countries and observations in the panel data.

Table (4): Description of the variables considered in the analysis

		GDPpw	GEI	BUSfr	STRbus	ECOFR	TRDop	HDI	GCF	GOVexp
BRA		24415.02	21.08	57.376	61.424	56.459	230637.5	.735	423913.4	417117.47
CHN		9863.282	33.80	51.429	71.165	53.765	1924036.	.712	3250187.	1180716.6
IND		4457.849	28.6	47.906	54.724	54.306	386241.6	.598	698633.6	208874
RUS		22066.33	25.32	65.006	85.353	52.947	457331.4	.793	365607.8	286879.71
ZAF		25756.08	33.07	70.359	78.788	62.224	99972.00	.67	77314.15	77600.85
Total	**Mean**	17311.7	28.37	58.41	70.29	55.94	619643.8	.7014	96313.3	434237.7
	Min	2676.29	11.9	35.5	24.1	49.8	56839.11	.53	56073.86	58061.11
	Max	26751.7	50.7	79.8	101.4	66.3	3164244	.828	5317970	2464580
Obs		N = 85, n = 5, T = 17								

Source: Authors' calculation using Stata/BE 17

The dependent variable mean, GDP per worker, among the BRICS countries is 17311.7, with South Africa having the highest value (25756.08) and India having the lowest value (4457.849). Likewise, the global entrepreneurship index (GEI) mean for BRICS countries under study is 28.37, where China had the highest index and Brazil had the lowest one. Likewise, the global entrepreneurship index (GEI) mean for BRICS countries under study is 28.37, where China had the highest index and Brazil had the lowest one. While business freedom (BUSfr) is 70.29, and Starting a Business (STRbus) is 58.41.

Table 7. shows the results of fixed effects estimation:

Table (7): Fixed effects model estimation

```
Fixed-effects (within) regression               Number of obs      =        85
Group variable: country                         Number of groups   =         5

R-squared:                                      Obs per group:
     Within  = 0.9692                                         min =        17
     Between = 0.1368                                         avg =      17.0
     Overall = 0.0398                                         max =        17

                                                F(8,72)            =    282.76
corr(u_i, Xb) = -0.6917                         Prob > F           =    0.0000

------------------------------------------------------------------------------
       lGDPpw |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
         lGEI |   .0207096   .0575316     0.36   0.720    -.0939775    .1353967
       lBUSfr |   .1432823   .0450403     3.18   0.002     .0534961    .2330685
      lSTRbus |   .2515183   .0586161     4.29   0.000     .1346692    .3683674
      lECOFR |   .3407267   .1161965     2.93   0.005     .1090932    .5723602
       lTRDop |   .0338883   .0361239     0.94   0.351    -.0381234        .1059
         lHDI |  -.3331995   .2450695    -1.36   0.178    -.8217366    .1553375
         lGCF |   .1941863   .0652231     2.98   0.004     .0641665    .3242062
      lGOVexp |   .3551363    .050714     7.00   0.000     .2540397    .4562329
        _cons |  -1.077245   .6658852    -1.62   0.110    -2.404662    .2501732
--------------+---------------------------------------------------------------
      sigma_u |   1.117489
      sigma_e |  .04292591
          rho |  .99852663   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(4, 72) = 193.20                     Prob > F = 0.0000
```

Source: Authors' calculation using Stata/BE 17

It is evident from the outputs of the previous table that the comparison between the pooled model and the fixed effects model based on the restricted Fisher statistic (F) test, which indicates the rejection of the null hypothesis and acceptance of the alternative hypothesis, meaning that the fixed effects model is the best. The next step is to estimate the random effects model:

Table (8): Random effects of model estimation

```
Random-effects GLS regression                   Number of obs      =        85
Group variable: country                         Number of groups   =         5

R-squared:                                      Obs per group:
     Within  = 0.7837                                         min =        17
     Between = 0.9944                                         avg =      17.0
     Overall = 0.9663                                         max =        17

                                                Wald chi2(8)       =   2182.52
corr(u_i, X) = 0 (assumed)                      Prob > chi2        =    0.0000

------------------------------------------------------------------------------
       lGDPpw |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
         lGEI |   .1356479   .0965415     1.41   0.160    -.0535699    .3248657
       lBUSfr |  -.0825917   .1412143    -0.58   0.559    -.3593665    .1941832
      lSTRbus |   .1836309   .1190999     1.54   0.123    -.0498006    .4170624
      lECOFR |   1.414996    .344054     4.11   0.000     .7406626    2.089329
       lTRDop |   .1283653    .106357     1.21   0.227    -.0800907    .3368212
         lHDI |   1.899727   .5667081     3.35   0.001     .7889995    3.010454
         lGCF |  -1.067992   .1395589    -7.65   0.000    -1.341522   -.7944614
      lGOVexp |   1.018702   .1120096     9.09   0.000     .7991675    1.238237
        _cons |   3.175609   1.360949     2.33   0.020     .5081988     5.84302
--------------+---------------------------------------------------------------
      sigma_u |          0
      sigma_e |  .04292591
          rho |          0   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Source: Authors' calculation using Stata/BE 17

After obtaining the estimates of the random-effects model, it is required to perform a Hausman test for the comparison between the fixed effects model and the random-effects model.

Table (9): Hausman test

```
                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       fe           re         Difference       Std. Err.
-------------+----------------------------------------------------------------
         lGEI |    .0207096     .1356479       -.1149383        .0497132
       lBUSfr |    .1432823    -.0825917        .2258739        .0153176
      lSTRbus |    .2515183     .1836309        .0678874         .046473
      lECOFR |    .3407267     1.414996       -1.074269        .0534078
       lTRDop |    .0338883     .1283653       -.0944769        .0169496
         lHDI |   -.3331995     1.899727       -2.232926        .1765407
         lGCF |    .1941863    -1.067992        1.262178        .0500186
      lGOVexp |    .3551363     1.018702       -.6635659        .0379898
------------------------------------------------------------------------------
                           b = Consistent under H0 and Ha; obtained from xtreg.
            B = Inconsistent under Ha, efficient under H0; obtained from xtreg.

Test of H0: Difference in coefficients not systematic

    chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
            = 772.79
Prob > chi2 = 0.0000
```

Source: Authors' calculation using Stata/BE 17

The output of the previous table shows the rejection of the null hypothesis and acceptance of the alternative hypothesis; therefore, the fixed effects model is the best. The next step is to run the diagnostic tests for the fixed-effects model. The next step is to run the diagnostic tests for the fixed effects model.

Table (4): Fixed-effects diagnostic tests

Pesaran's test of cross-sectional independence	Modified Wald test for groupwise heteroskedasticity in fixed effect regression model	Heteroskedasticity-robust Born and Breitung (2016) HR-test
-0.751, Pr = 0.4529	chi2 (5) = 92.26 Prob>chi2 = 0.0000	HR-stat = 1.96 p-value = 0.050

Source: Authors' calculation using Stata/BE 17

The result of the (Pesaran, 2004) test indicates the acceptance of the null hypothesis, which denotes that the model is devoid of the problem of cross-sectional dependence. According to the results of the modified Wald test above, we reject the null hypothesis and conclude heteroskedasticity. The (Born & Breitung, 2016) HR-test indicates the acceptance of the null hypothesis and the residuals do not have the first-order autocorrelation.

Diagnostics tests of the specified model suggest the presence of heteroscedasticity, and the absence of serial correlation and cross-sectional dependency. The modified Wald test for group-wise heteroscedasticity in the fixed effects regression model indicate the presence of heteroscedasticity (p-value=0.000). The fixed effects estimator is either inconsistent, biased, or inefficient in the presence of heteroscedasticity. To illustrate this, heteroscedasticity would make the estimates inefficient and their standard errors biased. Following (Baltagi B. , 2021), to correct for such bias in the standard errors, (Driscoll & Kraay, 1998) standard errors must be used.

Table (5): Estimation results of Driscoll- Kraay standard errors

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Regression with Driscoll-Kraay standard errors   Number of obs     =        85
Method: Fixed-effects regression                 Number of groups  =         5
Group variable (i): country                      F(  8,    16)     =   8425.71
maximum lag: 4                                   Prob > F          =    0.0000
                                                 within R-squared  =    0.9692

------------------------------------------------------------------------------
             |                    Drisc/Kraay
      lGDPpw |  Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
        lGEI |    .0207096   .0715472     0.29   0.776    -.1309637    .1723829
      lBUSfr |    .1432823   .0565122     2.54   0.022     .0234818    .2630827
     lSTRbus |    .2515183   .0786043     3.20   0.006     .0848846     .418152
      lECOFR |    .3407267   .1275621     2.67   0.017     .0703071    .6111463
      lTRDop |    .0338883   .0362741     0.93   0.364    -.0430094    .1107861
        lHDI |   -.3331995   .2696396    -1.24   0.234    -.9048099    .2384108
        lGCF |    .1941863   .0620407     3.13   0.006     .0626659    .3257067
     lGOVexp |    .3551363   .0530491     6.69   0.000     .2426773    .4675953
       _cons |   -1.077245   .6610884    -1.63   0.123    -2.478689    .3242002
------------------------------------------------------------------------------
```

Source: Authors' calculation using Stata/BE 17

The coefficient of two of the three entrepreneurship measures: 'Business Freedom' and ‘Starting a Business’ have significantly positive impact in explaining variation in output per worker. The coefficients of ‘Economic Freedom’, ‘Gross capital formation’, and ‘'government expenditure’ are statistically significant. They have positive impacts in explaining variation in output per worker. However, ‘Global Entrepreneurship Index’, ‘Trade openness’, and ‘Human Development Index’, are insignificant.

IV- Conclusion:

Growth theories, especially neoclassical, endogenous, and Schumpeterian growth theories, were used to evaluate the correlation between entrepreneurship and economic growth. In their studies, the majority of recent national and regional analytical research applied one of the economic growth paradigms, either directly or implicitly, to the entrepreneurial/economic growth nexus. The systematic analysis of scientific literature in general has shown that entrepreneurial activities have a favorable influence on economic performance. The analysis of growth theories and models, as well as the scientific literature tying entrepreneurship to economic growth, revealed a lack of unanimity, despite the fact that the number of research indicating favorable outcomes was dominant.

In the context of this study, we investigated the influence of entrepreneurship on economic growth in the BRICS countries during 2004-2020. The measurement and definitional challenges, as well as a study of theoretical and empirical literature, informed the selection of entrepreneurship and economic growth measures. The study's preliminary findings contribute to a review of the theoretical and empirical literature. (Schumpeter, 1931) introduced the entrepreneurship theory, which demonstrated the significance of entrepreneurship in encouraging economic development and growth. Motivated by Schumpeter's ideas, empirical literature has grown substantially in the last decades, in large part, shown the positive impact of entrepreneurial activity on economic growth. Early economic growth theories and models, on the other hand, remained mute and ignored the role of entrepreneurship.

The results using the static approach estimators, suggested that two coefficients of the three entrepreneurship measures: 'Business Freedom' and ‘Starting a Business’ have significantly positive impact in explaining economic growth. According to our research and investigation, while many studies have dealt with the significance of entrepreneurship in economic growth in many countries, studies that utilized the 'business freedom' and 'Starting a Business' are nearly non-existent. Nonetheless, the findings of this study were similar to the findings of several empirical studies on the significant impact of various types of entrepreneurship activities on economic growth. (Kasseeah, 2016) revealed that both measures of entrepreneurship: 'business density' and 'new business registrations,' are positively related to economic growth and support the hypothesis that entrepreneurship promotes economic development. In contrast, (Mekhzoumi & Gharbi , 2021) concluded that Total Early-Stage Entrepreneurial (TEA) is associated to an inverse relationship with GDP per person employed in 28 industrialized countries. They assessed that the variable is distinguished by the fact that it contains the total of emerging businesses and new projects, and these businesses may not embody the advantage of innovation and entrepreneurship. From their side, (Zaki & Rashid, 2016) found a significant inverse correlation between the number of new establishments, as a proxy for entrepreneurship, and economic growth. They emphasised that the cause of this unfavourable association might be traced to a variety of reasons. First, numerous studies have indicated that not all new businesses would have equal benefits on economic growth, since fast-growing enterprises generate the majority of new employment possibilities; nevertheless, these firms account for fewer than 5% of new firms founded. The results also indicated that a set of control variables have a significant effect on economic growth. Specifically, 'Gross capital formation', 'Economic Freedom', and 'government expenditure’ are suggested to have a positive impact on growth.

Researchers and policymakers' intensified emphasis on entrepreneurship as a trend impacting economic growth, makes the results of this study important to the government and the community of policymaking. In this sense, entrepreneurship is considered a key instrument for promoting economic growth in emerging countries. Governments need to be patient because the impact of entrepreneurship requires a period of adjustment. Governments need to be careful, and an

adjustment period is needed for the effects of entrepreneurship. The long-term benefits will significantly compensate for short-term losses. Governments should encourage both creativity and human capital at the same time to produce the best outcome. Especially, BRICS countries should pay more attention to human capital such as basic skill development, school quality, enhancing R&D efficiency, etc., in order to maximize the entrepreneurship benefits. Significant potential for growth Entrepreneurship is critical for long-term economic growth, and investing in developing a corporate climate favorable to growth-oriented entrepreneurial activity pays dividends. More significantly, the long-term benefits of growth-oriented entrepreneurship investment might drive politicians to implement plans and regulations that can offer the economic environment for fostering growth objectives as well as allowing new firm entrance.

This study had a number of limitations that may have impacted the findings and hampered their generalizability. This is primarily due to sample constraints. Just 17 years of data set can prevent detection of lag effects occurring only on longer time scales. A bigger collection of panel data, particularly in terms of time observations, may be more effective for investigating and clarifying the link between entrepreneurship and growth. There are restrictions in the set of nations covered in the data, in addition to time-dimensional constraints. Some of the research variables for a considerable number of BRICS nations are severely affected by missing data.

Future research at the micro and macro levels may include encompassing export-oriented (international) entrepreneurship, social entrepreneurship, and intrapreneurship. A continuation of this research in this approach would also make a significant contribution to the existing literature. The influence of social entrepreneurship on other stages of development and progress, such as poverty reduction and inequity reduction, will provide an important component of entrepreneurship's essence.

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