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The influence of entrepreneurship on economic growth in BRICS economies

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ABSTRACT

This study employs correlation analysis and a fixed effects model premised on indexes extracted through principal component analysis to assess the effects of entrepreneurial attitudes and behaviour, and entrepreneurial framework conditions (EFCs) on economic growth in BRICS economies. For purposes of effectiveness, a panel dataset for entrepreneurial attitudes and behaviour, and EFCs indicators is pooled from the Global Entrepreneurship Monitor website, and one for gross domestic product (GDP) per capita, a proxy for economic growth, is sourced from the World Bank website over the period 2001-2021. The study reveals that there are statistically significant negative correlations between GDP per capita and 'entrepreneurial intentions rate', 'perceived capabilities rate', 'perceived opportunities rate', 'governmental support and policies', 'taxes and bureaucracy', 'governmental programmes', 'internal market openness', 'physical and services infrastructure' and 'cultural and social norms'. Furthermore, entrepreneurial attitudes and behaviour positively impact GDP per capita, whereas EFCs have no significant influence on GDP per capita in BRICS economies.

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1. Introduction

The 2007–2009 global economic and financial crisis, also known as the Great Recession, had a significant negative impact on the world economy and took a toll on individuals and institutions in developing and developed economies. The crisis resulted in an upsurge in unemployment, contracted liquidity in financial markets, reduced economic growth levels, and a fall in international trade, consumption, and commodity prices, among many other things (see, for instance, Vatavu et al., 2022). Emerging economies, including BRICS (Brazil, Russia, India, China, and South Africa), were significantly affected by this crisis. The International Monetary Fund (IMF, 2009, 2010) notes that economic growth in developing and emerging countries fell from 13.8% in 2007 to 6.1% in 2008 and 2.1% in 2009. These economies

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continued to feel the effects beyond 2009 and experienced a long and slow recovery. Moreover, Tahir & Burki (2023) point to the literature that highlights that, of late, the BRICS countries' economic performance has been slowing down, with increased youth unemployment.

Governments across the world responded to the effects of the global financial crisis by introducing policies and frameworks to rekindle economic growth. In general, such strategies have been used by policymakers in contemporary times to address economic crises, global challenges, and societal ills. However, Stoica et al. (2020) observe that one of the most significant challenges confronting regional or national economies is identifying the determinants of economic development and growth. The literature identifies entrepreneurship as one of the drivers of economic growth even though it is not part of the neoclassical growth model, which links capital and labour to output. Hence, policymakers have supported businesses and directly and indirectly promoted entrepreneurship to encourage economic growth.

There is broad consensus in the extant literature that entrepreneurship stimulates economic growth at the regional and national level (Acs et al., 2005; Audretsch, 2007; Audretsch & Keilbach, 2004; Stoica et al., 2020; Urbano & Aparicio, 2016). In the same vein, Vatavu et al. (2022) posit that entrepreneurship is the mainstay of numerous countries. It promotes economic growth in several ways, including job creation, enhanced innovation and productivity, knowledge spill-overs, a competitive environment and more diverse products and services (Audretsch, 2007; Decker et al., 2014; Fritsch, 2008; Hermes & Lensink, 2007; Karlan & Valdivia, 2011; Milovic et al., 2020; Nwagu & Enofe, 2021; Savrul, 2017; Stoica et al., 2020; Vatavu et al., 2022). Wang & Shao (2023) posited that entrepreneurs' adoption of technological innovations promotes green technology and production technology, which ultimately promote energy efficiency. In turn, energy efficiency facilitates economic growth.

However, Xu et al. (2021) and Tang & Koveos (2004) note that there is no scholarly consensus on the relationship between entrepreneurship and economic growth. Some studies have produced mixed results due, among other things, to the fact that countries and regions have different entrepreneurial framework conditions (EFCs) and entrepreneurial behaviour and attitudes, and that there are diverse kinds of entrepreneurship (Acs et al., 2018; Stam & Van Stel, 2009, 2011; Stoica et al., 2020). Entrepreneurial behaviour and attitudes refer to individuals' attitudes and behaviour towards entrepreneurship. Gunewardena & Seck (2020) posit that individual entrepreneurial activity, attitudes and aspirations significantly impact entrepreneurship. EFCs comprise contextual factors in the economic environment. They refer to the entrepreneurial environment designed by the public sector to promote entrepreneurship in a country. Bosma et al. (2008) describe EFCs as 'the necessary oxygen of resources, incentives, markets, and supporting institutions to the growth of new firms'. Of late, the entrepreneurship literature has focused on entrepreneurial ecosystems where the entrepreneur, entrepreneurial venture, and contextual fundamentals interconnect (see Gomes et al., 2023; Pita et al., 2021a and references therein). An entrepreneurial ecosystem can be defined as a community of numerous co-existing stakeholders that provides a supportive environment for new ventures in a region (Cao & Shi, 2021). However, Cao & Shi (2021) assert that research on the entrepreneurial ecosystem has

been mainly atheoretical and static, and has typically focused on advanced countries. Due, among other things, to the unavailability of data, entrepreneurship as well as the entrepreneurial ecosystem are under-researched in developing countries, including BRICS (Cao & Shi, 2021; Kim et al., 2022; Lingelbach et al., 2005; Tahir & Burki, 2023).

There is no consensus in the literature on the relationship between entrepreneurship and economic growth. While some studies have revealed a positive association (Gungah & Jaunky, 2017; Vazquez et al., 2010), others conclude that there is a negative connection (Zaki & Rashid, 2016). In addition, some scholars assert that this relationship cannot be defined unless certain conditions are met (Urbano & Aparicio, 2016; Van Stel et al., 2005; Wennekers et al., 2005).

Entrepreneurship can be analysed at the individual, corporate, regional or national level (Pita et al., 2021a). However, there is a paucity of research on its effect on economic performance at the level of the national economy (Acs et al., 2014; Munyo & Veiga, 2022). Wong et al. (2005) maintain that this is partly due to the challenge of formally defining and measuring entrepreneurship. Gomes & Ferreira (2022) concur and observe that it is difficult to define a strong, effective entrepreneurship metric that permits comparisons among economies. As a result, most studies analyse the influence of entrepreneurship on economic performance at the industry or company level (Carree & Thurik, 2003; Savrul, 2017). This has led to calls for further research on entrepreneurships' impact on economic growth in the national economy (Farinha et al., 2020; Stoica et al., 2020).

Few studies have examined the relationship between entrepreneurship and economic growth in developing countries (Naude, 2010). The features of developing and developed economies are dissimilar. For example, Roundy (2017) notes that developing economies have access to fewer resources, while Cao & Shi (2021) point to the lack of digital innovation and structural and institutional gaps. The literature also notes that there are substantial variations with regard to the factors that promote economic growth in developing and developed economies (Farinha et al., 2020; Valliere & Peterson, 2009). Thus, entrepreneurship models and policies designed for developed countries may not produce the desired results when applied in their developing counterparts (see, for instance, Cao & Shi, 2021).

Against this background, this study employs correlation analysis and a fixed effects model premised on indexes extracted through principal component analysis (PCA) to assess the effects of entrepreneurial attitudes and behaviour, and EFCs on economic growth in BRICS economies. These economies are the fastest-growing emerging markets in the world, and they play a vital role in the global economic and geo-political arena. They are home to more than 40% of the global population and comprise approximately 30% of the land mass. For purposes of effectiveness, a panel dataset for entrepreneurial attitudes and behaviour, and EFCs indicators is pooled from the Global Entrepreneurship Monitor (GEM) website, and one for gross domestic product (GDP) per capita, a proxy for economic growth, is sourced from the World Bank website over the period 2001–2021. The study shows that there are statistically significant negative correlations between GDP per capita and 'entrepreneurial intentions rate', 'perceived capabilities rate', 'perceived opportunities rate', 'governmental support

and policies', 'taxes and bureaucracy', 'governmental programmes', 'internal market openness', 'physical and services infrastructure' and 'cultural and social norms'. Furthermore, it concludes that entrepreneurial attitudes and behaviour stimulate GDP per capita, while EFCs have no significant influence on GDP per capita in the BRICS countries.

This research contributes to the body of knowledge on the relationship between entrepreneurship and economic growth by offering novel insights into entrepreneurial behaviour and attitudes, and EFCs' influence on economic growth at the national level in BRICS economies. Using panel data, it thoroughly tests these associations over a prolonged observation period, thereby providing extensive analysis. To the best of the authors' knowledge, it is the first such study.

The remainder of this article is ordered as follows: Section 2 presents a literature review and Section 3 an overview of the data and methodology employed. Section 4 outlines the empirical results and analysis, while Section 5 presents conclusions, discusses the findings' implications and makes suggestions for future research.

2. Literature review

2.1. The concept of entrepreneurship

Entrepreneurship is a multi-faceted and interdisciplinary phenomenon that has links with fields like management, economics, and psychology (Ungureanu & Ciloci, 2023; Pita et al., 2021a). The functional roles of an entrepreneur are taking risks, embracing innovation, and searching for opportunities (Ungureanu & Ciloci, 2023). Proposing a single definition of entrepreneurship and its dimensions is thus a difficult task (Gomes & Ferreira, 2022) and there is no consensus on this issue in the literature. While Xu et al. (2021) define entrepreneurship as the 'enterpriser's spirit of adventure, reform and innovation to maximize profits and introduce new economic opportunities and economic ideas into the market under the condition of uncertain risks', and Gomes & Ferreira (2022) posit that it 'can be understood as the intention or action aiming to generate value through products, new methods or through new businesses'.

Under these circumstances, it is also difficult to identify a robust entrepreneurship metric that allows for comparisons among countries (Gomes & Ferreira, 2022). Gomes and Ferreira (2022) note that this is exacerbated by the existence of numerous international databases that employ diverse measures and dimensions of entrepreneurial activity. Numerous studies have used quantitative measures to assess entrepreneurship (Acs & Szerb, 2010), with the rate of self-employment and the number of new corporates commonly used in this regard (Acs & Szerb, 2010; Carree & Thurik, 2007).

However, Kim et al. (2022) point to shortcomings in quantitative measures of entrepreneurship. Gomes & Ferreira (2022) assert that using the number of new corporates is reductive as it does not include issues like entrepreneurial capacity, innovation, motivation, identified opportunity, and appetite to engage in such activity. Similarly, Baliamoune-Lutz (2015) argues that existing businesses also engage in entrepreneurship and Doran et al. (2018) describe the use of the number of corporates formed as a simplistic explanation of entrepreneurship. Thus, quantitative

entrepreneurship metrics do not paint the full picture (Baliamoune-Lutz, 2015; Doran et al., 2018). Pita et al. (2021a) point to the need for a more detailed analysis of the ecosystem since entrepreneurship is a multi-dimensional and sophisticated phenomenon (see Acs & Szerb, 2010).

Wong et al. (2005) are of the view that the reliance on quantitative measures is due to difficulties in identifying superior metrics that can be evaluated econometrically to examine entrepreneurship's influence on economic growth. Doran et al. (2016) point to the need for robust measures to analyse this relationship. In response to the shortcomings of quantitative entrepreneurship measures, several novel entrepreneurship indicators have been proposed, including entrepreneurial attitudes and behaviour, and EFCs indicators (Acs & Szerb, 2010; Doran et al., 2018; Vatavu et al., 2022).

Entrepreneurship can be categorised into three levels, namely, macro, corporate, and personal (Ungureanu & Ciloci, 2023; Xu et al., 2021). At the macro level, it focuses on the entire economy and society as the conduits of entrepreneurship and is concerned with the association between entrepreneurs and their institutional context (see, for instance, Appold, 2000; Doran et al., 2018; Gomes et al., 2022, 2023; Gomes & Ferreira, 2022; Vatavu et al., 2022). This acknowledges that entrepreneurs do not operate in a vacuum, but are affected by the context in which they operate.

At the individual level, entrepreneurship concentrates on the individual features of entrepreneurs. Xu et al. (2021) note that Jing et al. (2016) identified such features as risk-taking, innovative, psychological traits, and the economic, cultural, and social milieu, among other factors. In the same vein, Ungureanu & Ciloci (2023) posit that entrepreneurship is driven by people's attitudes, skills, goals, and behavioural inclinations. Pita et al. (2021b) note that behavioural theories have thus been employed to understand individuals' entrepreneurial behaviour. Indeed, in some circles, entrepreneurship is regarded as a behavioural feature of individuals. Xu et al. (2021) cite Liu & Wang (2018) who assert that entrepreneurship at the individual level can be understood in relation to four abilities, namely the ability to discover and to apply cognitive skills, coordinate knowledge, and take advantage of opportunities. At the company level, entrepreneurship focuses on the common features of successful enterprises. These include, among other things, the company culture and style of management.

2.2. Entrepreneurship and economic growth

Economic growth is a vital macroeconomic variable and its achievement has been a primary goal of every country since the mid-twentieth century. It can be generally defined as a continual rise or improvement in a country's GDP over a specific period of time. Given that economic growth enhances the standard of living, it has assumed centre stage when it comes to economic planning and the identification of priorities. Hence, numerous studies have been conducted to address issues related to economic growth and it is a focus of governments seeking re-election While economic growth is driven by a number of factors, many governments promote entrepreneurship in order to enhance it.

The proposition that entrepreneurship stimulates economic growth first emerged at the beginning of the nineteenth century (see Schumpeter, 1911) and since then, numerous studies have tested this assumption (see Baumol, 1990 and Schumpeter, 1942). In contemporary times, there is overall consensus that entrepreneurship is positively associated with economic growth and development (Bosma et al., 2018; Galindo & Mendez, 2014; Gomes et al., 2022; Gu et al., 2021; Munyo & Veiga, 2022; Stoica et al., 2020; Tahir & Burki, 2023; Wang & Shao, 2023) although it is not part of the neoclassical growth model, which connects capital and labour to output (Audretsch, 2007; Audretsch & Keilbach, 2004). Sagar et al. (2023) postulate that entrepreneurship plays a vital, multi-faceted role in promoting economic growth and development. Acs et al. (2005) examined the degree to which entrepreneurship encourages economic growth and found that it positively influences economic growth alongside investment in research and human capital.

Xu et al. (2021) assert that entrepreneurship influences economic growth through competition, innovation, industrial agglomeration, and increased employment. Sagar et al. (2023) are of the view that, as economies develop and international markets become progressively interlinked, entrepreneurship plays an increasingly important role in generating employment opportunities, promoting innovation, and encouraging productivity. Innovative entrepreneurs are the key agents of the on-going Schumpeterian process of creative destruction; they are a menace to existing corporates that are not performing well and inspire competition that allows countries to thrive (Kim et al., 2022; Tahir & Burki, 2023). Furthermore, Wang & Shao (2023) note that digital technology has altered the management and production mode, led to the emergence of new industries and promoting the constant growth of market scale, which exposes entrepreneurs to additional opportunities. The authors add that the digital economy could decrease information asymmetry and thus reduce or enable avoidance of entrepreneurial risks. Gaba & Gaba (2022) state that entrepreneurial activity facilitates economic growth through employment and innovation. Galindo & Mendez (2014) highlighted a close association between economic growth, entrepreneurship and innovation. They identified a virtuous cycle among these variables in which each positively influences the others.

Using a dataset for the BRICS countries over the period 2002–2021 and several estimation techniques (i.e., fixed effects, pooled least squares, two stages least squares, and generalised least squares), Tahir & Burki (2023) analysed the relationship between economic growth and entrepreneurship and found that entrepreneurship has a significant positive influence on economic growth in the BRICS economies. They also identified a one-way association from entrepreneurship to economic growth. Furthermore, Tahir & Burki (2023) found that physical capital and trade openness encourage economic growth and established a significant and positive relationship between human capital and economic growth in the BRICS economies. Gaba & Gaba (2022) employed a dataset for the BRICS countries over the period 2014–2018 and the dynamic ordinary least squares model to test the associations among economic growth, total early-stage entrepreneurial activity, entrepreneurial intention, the high job creation expectation rate and the established business ownership rate. The study concluded that entrepreneurial intention is a significant driver of economic growth in

these economies. At the national level, Savrul (2017) assessed the effect of entrepreneurial activities on economic growth using data for 35 economies over the period 2006–2015 and concluded that there is a positive association between economic growth and entrepreneurship in the long run.

Although there is overall consensus that entrepreneurship positively impacts economic growth, this is not always the case (Chhabra et al., 2023; Dvoulety et al., 2018; Xu et al., 2021). Not all entrepreneurship leads to growth (Xu et al., 2021) and Gomes et al. (2022) note that some studies on the link between regional economic growth and entrepreneurship have proven this to be the case. Zaki & Rashid (2016) research on entrepreneurship's effect on economic growth in seven emerging economies, i.e., Egypt, India, Hungary, Mexico, Turkey, Indonesia, and Romania over the period 2004–2014 found a negative association. Using a panel dataset for the Group of 8 (G8) economies pooled over the period 2001–2018, Vatavu et al. (2022) concluded that entrepreneurial attitudes and behaviour are negatively related to economic growth, while EFCs are positively associated. Lastly, Kim et al. (2022) study that employed a panel dataset for 111 developed, and emerging and developing countries over a period of 19 years (2001–2019) found no proof of a positive association between economic growth and aggregate entrepreneurship.

The mixed results on entrepreneurship's influence on economic growth are due to the fact that this association is impacted by, among other factors, the business environment and quality of governance in a jurisdiction as well as the type of entrepreneurship under consideration (Gomes et al., 2022; Gu et al., 2021; Hamdan et al., 2022; Khyareh & Amini, 2021; Wong et al., 2005). Munyo & Veiga (2022) observe that there is limited empirical literature on effect of entrepreneurship on economic growth at the country level and that the results are contradictory or mixed depending on the type of entrepreneurship taken into account and the macroeconomic context of the country. Similarly, Stam & Van Stel (2009) observe that the mixed findings are partly due to the features of the macroeconomic environment in which economic growth occurs.

2.3. Entrepreneurship and economic development

An analysis of the available evidence indicates that entrepreneurship's impact on economic growth is contingent on a country's stage of economic development (Amoros et al., 2012; Bosma et al., 2009; Ferreira et al., 2017; Gries & Naude, 2010; Kim et al., 2022; Urbano & Aparicio, 2016). Autio (2007) notes that this factor as well as the institutional context result in wide-ranging differences in relation to entrepreneurial activity. Doran et al.'s (2018) study that drew on a panel dataset for 55 undeveloped and advanced economies for the period 2004–2011 concluded that several entrepreneurship indicators' impact on economic growth varies depending on a country's level of economic development. Hence, Valliere & Peterson (2009) recommended that, in order to increase the generalisability of the findings, future research on the link between economic development and entrepreneurship should consider diverse kinds of entrepreneurship and the stage of economic development of the economies under examination.

Several authors have noted that different empirical results have been obtained on entrepreneurship's influence on economic growth in developed and developing countries (Stam & Van Stel, 2009; Sternberg & Wennekers, 2005; Valliere & Peterson, 2009; Zaki & Rashid, 2016) since these two groups of countries are marked by different economic conditions (Valliere & Peterson, 2009). This supports the notion that entrepreneurial ecosystems in underdeveloped economies cannot be compared to those in their developed counterparts since the characteristics of their macroeconomic environments differ.

Several studies have concluded that entrepreneurship has a more positive or greater impact on economic growth in advanced than in emerging economies (see, for instance, Lepojevic et al., 2016). Using a panel dataset for 55 countries over the period 2004–2011 and 14 diverse variables, Doran et al. (2018) found that entrepreneurial attitudes positively and significantly affect GDP per capita in high-income economies, whereas entrepreneurial activity negatively impacts GDP per capita in middle/low-income countries. Van Stel et al. (2005) surveyed 36 countries and concluded that entrepreneurial activity has an adverse influence on economic growth in poor economies, but a positive influence in rich ones. Sautet (2013) postulated that entrepreneurship positively influences economic growth in advanced economies, while there is a lack of proof of such in underdeveloped economies. Valliere & Peterson (2009) study that drew on data for 44 countries over the period 2004–2005 revealed that entrepreneurship does not affect economic growth in developing countries. Utilising a sample of 36 economies for the timeframe 2002–2005, Stam & Van Stel (2009) found that entrepreneurship does not influence economic growth in low-income economies, while the opposite is true for transition and high-income ones.

Kim et al. (2022) categorised early-stage entrepreneurship into necessity-driven and opportunity-driven entrepreneurship, and the sample countries into developed, emerging and developing countries. The study concluded that opportunity-driven entrepreneurship (rather than aggregated entrepreneurship) is positively related to economic growth in developing countries that have a relatively large manufacturing base. Stam et al. (2011) revealed that entrepreneurship has no substantial influence on economic growth in high-income economies, but a meaningful, positive effect in low-income economies.

The literature on developing countries presents mixed results, with some studies pointing to entrepreneurship having no influence on economic growth (see, for instance, Valliere & Peterson, 2009), while others trace a positive link (see, for example, Wong et al., 2005), and yet others reveal a negative association (see, for instance, Doran et al., 2018). These contradictory results highlight the need for the relationship between economic growth and entrepreneurship to be clarified. The available evidence offers inadequate analysis of the drivers of entrepreneurship, making this a topic of interest to practitioners, academics, and policymakers. Kim et al. (2022) also observe that the majority of previous studies on economic growth and entrepreneurship concern advanced rather than developing countries. Xu et al. (2021) concur and add that several studies that indicate that entrepreneurship positively influences economic growth relate to developed economies, with comparatively few

on developing economies. They thus conclude that only tentative conclusions can be drawn on this relationship in developing countries and call for further research.

Based on the reviewed literature and the above discussion, we formulate the following hypotheses:

H_1: Entrepreneurial attitudes and behaviour positively impact economic growth in BRICS economies.

H_2: EFCs have a positive influence on economic growth in BRICS economies.

3. Data and methodology

In order to observe the relationship between entrepreneurial attitudes and behaviour, and EFCs and economic growth, we draw on two panel datasets for the BRICS countries for the period 2001–2021. The data on entrepreneurial attitudes and behaviour, and EFCs was obtained from the GEM website, and that on GDP per capita from the World Bank website. The GEM gathers entrepreneurship data for both developing and developed economies at the level of the economy with annual scores, which makes comparisons among countries much easier (Doran et al., 2018; Rietveld & Patel, 2023; Sitaridis & Kitsios, 2020). Doran et al. (2018) note that it applies dependable and unvarying definitions of entrepreneurial variables across countries, facilitating comparability. The myriad of entrepreneurial indicators suggested by the GEM enable a comprehensive examination of entrepreneurship. Furthermore, it addresses some of the grey areas in relation to the definition of entrepreneurship as well as some of the shortcomings of quantitative measures of entrepreneurship by proposing suitable metrics (see, for instance, Wong et al., 2005). Thus, the GEM website is one of the most authoritative sources of data on entrepreneurship. The sample we adopted has (105×11) observations. The period 2001–2021 was selected based on data availability. Data on entrepreneurship is not available for any of the BRICS economies prior to 2001. GDP per capita was adopted as it is a well-recognised and commonly used indicator of economic growth.

The entrepreneurial behaviour and attitudes, and EFCs variables (with acronyms in brackets) used in this study are outlined in Table 1. In line with Vatavu et al. (2022), we adopt five entrepreneurial attitudes and behaviour variables, and six EFCs indicators.

Data on these variables is missing for certain years in some countries. Rather than removing observations with missing data, we impute the missing values using mean imputation. In this technique, the datasets are subdivided according to countries. The missing values for indicators in each country are swapped with the mean of the non-missing values. Mean imputation is easy to implement and quick to execute. Furthermore, we observe that the scores for the entrepreneurial behaviour and attitudes and EFCs indicators are less than 100. Therefore, we implement the logarithm of GDP per capita as our dependent variable to ensure that the GDP per capita level is identical to the level of the entrepreneurial behaviour and attitudes, and EFCs variables.

Table 1. Entrepreneurial attitudes and behaviour and EFCs variables.

Variable	Definition
Panel A: Entrepreneurial attitudes and behaviour variables	
Total early-stage entrepreneurial activity (tea)	% of the population aged 18–64 who are a nascent entrepreneur or owner-manager of a new business
Entrepreneurial intentions rate (inten)	% of the population aged 18–64 who are inactive entrepreneurs and who aim to establish a business in the next three years
Fear of failure rate (fear)	% of the population aged 18–64 who specify that fear of failure could hinder them from starting a business
Perceived capabilities rate (pcap)	% of the population aged 18–64 who think they have the knowledge and skills required to start a business
Perceived opportunities rate (popp)	% of the population aged 18–64 who perceive good opportunities to begin a corporation in the area where they live
Panel B: EFCs variables	
Governmental support and policies (govsup)	The degree to which public policies promote entrepreneurship as an appropriate economic activity
Taxes and bureaucracy (taxb)	The degree to which public policies promote entrepreneurship—regulations or taxes are size-neutral or promote new businesses and small and medium enterprises (SMEs)
Governmental programmes (govprog)	The existence and calibre of programmes directly supporting SMEs at all levels of government
Internal market openness (mktope)	The degree to which new corporates are free to penetrate prevailing markets
Physical and services infrastructure (physerv)	Ease of accessing physical resources at a price that does not discriminate against SMEs
Cultural and social norms (culsoc)	The degree to which cultural and social norms promote or permit activities resulting in novel business approaches or action that can grow personal income and wealth

Source. GEM (2022).

Our analysis is presented in three phases. First, we analyse the correlation coefficients between entrepreneurial behaviour and attitudes, and EFCs variables, and GDP per capita. The primary emphasis is on the statistically significant correlation coefficients. Second, implementing PCA, we extract indexes from the entrepreneurial behaviour and attitudes, and EFCs indicators. The first set of indexes is constructed from the entrepreneurial behaviour and attitudes variables, and the second set from the EFCs indicators. PCA reduces the number of covariates and deals with the multicollinearity challenge that can exist between variables, while retaining much of the initial predictive power of the data (Doran et al., 2018). Third, we examine the impact of the extracted indexes on GDP per capita using the fixed effects model. This model allows us to assess the influence of entrepreneurial indicators that change over time on economic growth.

We implement the fixed effects model described by

$$GDP_{it} = \ a_i + \ \beta_1 PC_{1it} + \beta_2 PC_{2it} + \ldots \ + \beta_k PC_{kit} + \ e_{it},$$

Where, for the i^{th} country at time t, GDP_{it} is GDP per capita (logarithm), a_i is the intercept, $\beta_1 \ldots \ \beta_k$ are regression coefficients, $PC_{1it} - PC_{kit}$ are indexes extracted through PCA, and e_{it} is the error term.

Table 2. Descriptive statistics for GDP per capita and entrepreneurial behaviour and attitudes indicators.

Country	log(gdp)		popp		pcap		fear		inten		tea	
	Avg.	*SD*	Avg.	*SD*	Avg.	*SD*	Avg.	*SD*	Avg.	*SD*	Avg.	*SD*
Brazil	3.86	0.21	44.93	6.51	55.47	4.79	35.94	4.66	29.22	9.61	16.45	3.81
Russia	3.91	0.26	23.09	5.77	25.75	6.38	43.83	5.51	4.28	2.32	5.24	1.74
India	3.07	0.22	54.36	14.73	56.89	14.57	42.93	8.93	23.16	9.28	10.73	2.40
China	3.63	0.35	35.78	10.48	35.97	9.00	35.50	6.92	24.87	7.83	13.92	3.28
South Africa	3.78	0.13	36.14	10.48	40.53	9.37	33.01	6.81	11.61	3.26	8.02	2.89
Total Sample	3.65	0.39	38.86	14.43	42.92	15.07	38.24	7.90	18.63	11.63	10.87	4.94

Source. Authors' computations.

Table 3. Descriptive statistics for EFCs indicators.

	govsup		taxb		govprog		mktope		physerv		culsoc	
	Avg.	*SD*	Avg.	*SD*	Avg.	*SD*	Avg.	*SD*	Avg.	*SD*	Avg.	*SD*
Brazil	3.49	0.42	2.54	0.26	3.77	0.38	3.66	0.27	5.29	0.31	4.23	0.38
Russia	3.79	0.30	3.52	0.26	3.55	0.25	3.69	0.26	5.59	0.35	4.25	0.42
India	4.93	0.73	4.09	0.55	4.57	0.57	4.80	0.43	6.24	0.45	5.27	0.43
China	4.93	0.37	4.75	0.40	4.51	0.26	4.56	0.31	6.81	0.28	5.47	0.63
South Africa	4.71	0.55	3.46	0.20	3.51	0.25	3.94	0.38	5.28	0.43	4.31	0.29
Total Sample	4.37	0.78	3.67	0.82	3.98	0.59	4.13	0.57	5.84	0.70	4.71	0.70

Source. Authors' computations.

4. Empirical results and analysis

Tables 2 and 3 summarise the adopted variables' descriptive statistics (mean and standard deviation). These reveal the vital features of the variables and help to reveal the substantial variance across economies.

In terms of economic growth, Table 2 indicates that Russia has the highest GDP per capita, followed by Brazil, and India has the lowest. We now examine the descriptive statistics for the entrepreneurial attitudes and behaviour indicators. 'Tea' and 'entrepreneurial intentions rate' are highest in Brazil and smallest in Russia. Russia has the greatest 'fear of failure rate' (43.83%), while South Africa has the smallest (33.01%). On average, 38.24% of people aged 18–64 in the BRICS economies are unable to create businesses due to fear of failure. Overall, 42.92% of the population aged 18–64 in BRICS countries believe they have the skills and knowledge required to start a business as indicated by the 'perceived capabilities rate', which has the highest value in India (56.89%) and the lowest in Russia (25.75%). The 'perceived opportunities rate' is greatest in India (54.36%) and smallest in Russia (23.09%).

The descriptive statistics for the EFCs variables indicate that India is evaluated as offering programmes that support SMEs at all levels of government (4.57), with South Africa ranked last (3.51). 'Governmental support and policies', 'taxes and bureaucracy', and 'cultural and social norms' are highly evaluated in China and the least least in Brazil. Regarding 'internal market openness', India offers the most support to new corporates seeking to penetrate prevailing markets, while Brazil provides the least. China is evaluated the highest for 'physical and services infrastructure' (6.81) and South Africa the lowest (5.28).

Table 4 presents the correlation coefficients between the variables. All the adopted entrepreneurial indicators, except 'fear of failure rate' and 'tea', have a substantial

Table 4. Correlation coefficients between variables.

	log(gdp)	popp	pcap	fear	inten	tea	govsup	tax	govprog	mktope	physerv	culsoc
log(gdp)	1											
popp	−0.286**	1										
pcap	−0.269**	0.917**	1									
fear	0.010	0.330**	0.221*	1								
inten	−0.321**	0.568**	0.624**	−0.138	1							
tea	−0.037	0.445**	0.542**	−0.136	0.768**	1						
govsup	−0.341**	0.214*	0.000	0.075	−0.012	−0.114	1					
tax	−0.337**	0.133	−0.102	0.188	0.037	−0.065	0.737**	1				
govprog	−0.441**	0.479**	0.314**	0.209*	0.375**	0.245*	0.674**	0.705**	1			
mktope	−0.563**	0.462**	0.307**	0.138	0.313**	0.112	0.714**	0.765**	0.805**	1		
physerv	−0.337**	0.149	−0.027	0.158	0.214*	0.103	0.545**	0.762**	0.722**	0.624**	1	
culsoc	−0.435**	0.344**	0.148	0.173	0.310**	0.111	0.647**	0.764**	0.813**	0.814**	0.723**	1

**Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed). *Source*. Authors' computations.

Table 5. Panel unit root tests.

	PP - Fisher Chi-square	
Variable	Statistic	Prob**
log(gdp)	34.0650	0.0002
popp	28.9716	0.0013
pcap	20.3078	0.0265
fear	27.5664	0.0021
inten	19.3005	0.0366
tea	30.1361	0.0008
govprog	42.4079	0.0000
tax	42.3697	0.0000
govsup	28.1400	0.0017
mktope	45.3946	0.0000
physerv	40.5165	0.0000
culsoc	40.2513	0.0000

**Fisher tests probabilities are calculated using an asymptotic Chi-square distribution. However, all other tests presume asymptotic normality.
Source. Authors' computations.

effect on GDP per capita considering the magnitude of the correlation coefficients and their statistical significance. Interestingly, all the indicators with a statistically significant impact on GDP per capita are associated with negative correlation coefficients, indicating that as their values increase, economic growth falls. Premised on the correlation coefficients, we conclude that entrepreneurial attitudes and behaviour, and EFCs affect economic growth in the BRICS economies. Furthermore, we observe that some of the entrepreneurship indicators are highly correlated with each other (e.g., culsoc and govprog, and culsoc and mktope). To address the problem of multicollinearity in regression, we implement PCA to extract indexes from the adopted entrepreneurship variables.

The adopted data needs to be stationary to prevent spurious regression determinants in the designed model. We use the PP-Fisher Chi-square unit root test to assess data stationarity. Table 5 presents the results of the unit root tests. They show that the adopted data has no unit root. The data is stationary at the 5% level. We perform the tests for unit root in level and with individual intercept term in every testing equation.

Table 6. Eigenvalues.

Panel A: Entrepreneurial behaviour and attitudes variables		
Component	Eigenvalue	Cumulative proportion
PC1	2.949	58.988
PC2	1.301	85.014
PC3	0.461	94.240
PC4	0.216	98.561
PC5	0.072	100.000
Panel B: EFCs variables		
Component	Eigenvalue	Cumulative proportion
PC1	4.613	76.875
PC2	0.482	84.911
PC3	0.376	91.184
PC4	0.238	95.158
PC5	0.166	97.928
PC6	0.124	100.000

Source. Authors' computations.

Table 7. Principal component analysis indexes.

Indicator	PC1	PC2	Indicator	PC3
popp	0.878	0.352	govsup	0.817
pcap	0.915	0.221	taxb	0.900
fear	0.139	0.904	govprog	0.899
inten	0.846	−0.365	mktope	0.901
tea	0.778	−0.421	physerv	0.830
			culsoc	0.908

Table 6 lists the extracted principal components (and their eigenvalues) and the variance explained by the constructed principal components. In line with convention, principal components with eigenvalues less than 1 are eliminated from the analysis, and those with eigenvalues bigger than 1 are adopted (see Scholes, 2010). Therefore, we adopt the first two indexes from those extracted from the entrepreneurial behaviour and attitudes indicators since they have eigenvalues greater than 1. As indicated by the cumulative proportion, these indexes explain 85.01% of the variance. Likewise, we adopt the first index from the indexes extracted from EFCs variables since it is the only index with an eigenvalue greater than 1. As shown by the cumulative proportion, this index explains 76.88% of the variance.

Table 7 shows the factor loadings, i.e., the correlation coefficients between the variables and principal components extracted. To avoid confusion, from now onwards, we rename the adopted index from the EFCs indicators PC3.

On PC1, the most significant impact emanates from 'perceived capabilities rate', 'perceived opportunities rate', 'tea' and 'entrepreneurial intentions rate', and the smallest from 'fear of failure rate'. All the entrepreneurial attitudes and behaviour indicators have a positive impact on PC1. Hence, countries with a higher 'perceived capabilities rate', 'perceived opportunities rate', 'tea', 'entrepreneurial intentions rate' and 'fear of failure rate' have a higher PC1 value. Considering PC2, the most substantial influence originates from 'fear of failure rate' and 'tea' and the least from 'perceived capabilities rate'. 'Entrepreneurial intentions rate' and 'tea' are the only indicators that negatively influence PC2. Therefore, economies obtain higher scores for PC2 when the values for 'perceived capabilities rate', 'fear of failure rate' and 'perceived opportunities rate' are

Table 8. Fixed effects model.

Indicator	Coefficient	Std. Error	*t*-Statistic	Prob.
PC1	−0.024129	0.045630	−0.528798	0.5982
PC2	0.120380	0.031828	3.782208	0.0003
PC3	−0.007458	0.050459	−0.147811	0.8828
Constant	3.652908	0.022547	162.0119	0.0000
Adjusted *R*-squared	0.651124			
F-statistic	28.72863			
Prob(*F*-statistic)	0.000000			

Source. Authors' computations.

high, while those for 'tea' and 'entrepreneurial intentions rate' are low. On PC3, significant influence emanates from all the adopted EFCs variables. Interestingly, all the EFCs indicators have a positive influence on PC3. Thus, higher evaluation values for 'governmental support and policies', 'taxes and bureaucracy', 'governmental programmes', 'internal market openness', 'physical and services infrastructure' and 'cultural and social norms' increase the score for PC3.

Table 8 presents the regression results. Our regression analysis is premised on the fixed effects model. We examine the influence of entrepreneurial attitudes and behaviour, and EFCs on economic growth using this model. More specifically, we regress the PCA indexes on GDP per capita at the 95% confidence level. The analysis employs the Hausman test to select the best model for the data between the fixed effects and the random effects models. The *p*value for the Hausman test is $p = 0.0000$. Since this is less than 5%, we use the fixed effects model.

The results of the model indicate that PC1 and PC3 are not statistically significant and are associated with negative regression coefficients, while PC2 is statistically significant and is linked to a positive regression coefficient. Adjusted *R*-squared is used as the goodness of fit measure. The developed model is associated with an adjusted *R*-squared value of 0.6511, indicating that the designed model can describe 65.11% of the variance in GDP per capita. Therefore, the designed model can be regarded as a good one.

The regression results suggest that entrepreneurship attitudes and behaviour, represented by PC2, have a significant positive influence on economic growth (i.e., H_1 is accepted), while EFCs have no significant influence on economic growth (i.e., H_2 is rejected). The implication is that as the value of PC2 increases, GDP per capita surges. This finding contradicts that of Vatavu et al. (2022) who found that entrepreneurship behaviour and attitudes stymie economic growth in G8 economies. To gain more insight into PC2, we examine its composition. The most substantial influence on PC2 is the 'fear of failure rate' (0.904), followed by 'tea' (−0.421), 'entrepreneurial intentions rate' (−0.365), 'perceived opportunities rate' (0.352) and lastly, 'perceived capabilities rate' (0.221). This infers that the 'perceived capabilities rate', 'fear of failure rate' and 'perceived opportunities rate' positively affect economic growth, and low levels of 'entrepreneurial intentions rate' and 'tea' result in high levels of economic growth in the BRICS economies. Therefore, promoting recognition of opportunities and belief in individual capabilities are vital, as are vulnerability to positive fear of failure and reducing the effects of the 'entrepreneurial intentions rate' and 'tea'.

Fear of failure has a surprisingly positive influence on economic growth. Although this result goes against our intuition, it can be explained. While it is widely

documented that fear of failure can inhibit entrepreneurial activity (Arshed et al., 2022; Dutta & Sobel, 2021), it can promote success since it forces entrepreneurs to work harder, solve problems, exercise more care in what they do, reach out to mentors and educate themselves to be the best when developing their businesses (see, for instance, Hayton & Cacciotti, 2018). Hayton & Cacciotti (2018) interviewed 65 entrepreneurs in the United Kingdom and Canada. They found that fear of failure is prevalent and has both positive and negative impacts on decision-making, motivation, and behaviour. Hayton & Cacciotti (2018) concluded that fear of failure could motivate an individual to strive for success rather than discourage him/her from becoming an entrepreneur. However, Matenda & Sibanda (2023) concluded that fear of failure is negatively related to economic growth since it inhibits the establishment of companies. Gunewardena & Seck (2020) also postulated that fear of failure has an adverse influence on economic growth since it negatively impacts an individual's assessment of his/her skills and capabilities and is linked to risk aversion, thereby discouraging the pursuit of entrepreneurial activities. Furthermore, Vatavu et al. (2022) revealed that fear of failure negatively influences economic growth in G8 economies.

This study's results indicate that the 'perceived capabilities rate' is positively related to economic growth in BRICS countries. This is not surprising since people with capabilities are willing to take risks, are creative and take advantage of business opportunities (Arshed et al., 2022). However, Gomes & Ferreira (2022) survey of a sample of European economies concluded that perceived capacities have an adverse association with economic growth. Vatavu et al. (2022) found that the 'perceived capabilities rate' negatively influences economic growth. Furthermore, Matenda & Sibanda (2023) investigation of the relationship between entrepreneurship and economic growth in South Africa revealed an adverse relationship between the 'perceived capabilities rate' and economic growth. They suggested that South Africans' perceived capabilities are insufficient to stimulate economic growth, particularly in the era of the 4th Industrial Revolution and against the background of the rapidly changing digital economy.

This study also showed that the 'perceived opportunities rate' is positively related to economic growth in the BRICS countries. This can be explained by the fact that these economies are investing heavily in business incubators that offer training to transform their vision into reality and have enhanced networks that assist them to recognise feasible opportunities and to access additional resources (Rani & Kumar, 2022). It is in line with Gomes & Ferreira (2022) who concluded that perceived opportunities are positively connected to economic growth. However, Vatavu et al. (2022) indicated that the 'perceived opportunities rate' is negatively associated with economic growth.

The negative influence of 'tea' on economic growth may be due to the fact that, the BRICS economies lack a sufficient number of large businesses, and entrepreneurs have low levels of human capital (see Matenda & Sibanda, 2023; Van Stel et al., 2005). Most of the entrepreneurs in BRICS countries are marginal ones (see, for instance, Matenda & Sibanda, 2023). In line with this finding, Gomes & Ferreira (2022) concluded that 'tea' has an adverse relationship with economic growth in European countries. Van Stel et al. (2005) found that it has a significantly positive impact on economic growth in relatively rich countries, but a significantly negative influence on such growth in developing countries. Khyareh's (2023) survey of 54

economies over the period 2008–2020 that drew on GEM data revealed that 'tea' has a positive association with economic growth.

The research indicates that there is a negative relationship between the 'entrepreneurial intentions rate' and economic growth. This could be due to the fact that the intention to start a business might be nascent in BRICS economies. Similarly, Vatavu et al. (2022) highlighted that a high level of entrepreneurial intention leads to a decline in economic growth in G8 economies. However, Gaba & Gaba (2022) posited that the 'entrepreneurial intentions rate' is positively related to economic growth.

This study concluded that EFCs have no substantial effect on economic growth in the BRICS economies. The reason could be that the adopted EFCs indicators may not be sufficient to encourage economic growth in these countries. Contrary to our findings, Vatavu et al. (2022) concluded that EFCs have a significant positive influence on economic growth in the G8 economies. Gomes et al. (2023), Gomes et al. (2022), Bosma et al. (2018) and Mihaila (2015) also acknowledge the significance of EFCs in promoting economic growth. In a nutshell, this study's findings are congruent with the results of extant studies that aver that entrepreneurship is essential for economic growth (see, for example, Doran et al., 2018; Gomes et al., 2022, 2023; Vatavu et al., 2022).

5. Conclusions

This study employed correlation analysis and the fixed effects model premised on indexes extracted through PCA to examine the influence of entrepreneurial attitudes and behaviour, and EFCs on economic growth in the BRICS economies. For purposes of effectiveness, a panel dataset for entrepreneurial attitudes and behaviour, and EFCs indicators was pooled from the GEM website, and one for GDP per capita was extracted from the World Bank website over the sample period 2001-2021. The study revealed statistically significant negative correlation coefficients between GDP per capita and 'entrepreneurial intentions rate', 'perceived capabilities rate', 'perceived opportunities rate', 'governmental support and policies', 'taxes and bureaucracy', 'governmental programmes', 'internal market openness', 'physical and services infrastructure' and 'cultural and social norms'. Furthermore, the analysis suggests that entrepreneurial attitudes and behaviour stimulate GDP per capita, whereas EFCs have no significant influence on such in the BRICS economies. That is, entrepreneurial attitudes and behaviour have a positive influence on economic growth (confirming H_1), while EFCs have none (rejecting H_2).

These results are important since a lack of evidence on the drivers of entrepreneurship in a given environment can render entrepreneurship policies defective and cause them to miss their targets. They can also be cautiously applied in other developing economies since the BRICS economies are the fastest growing emerging markets in the world. The policy implications of the study's results are: (i) policymakers should consider entrepreneurial attitudes and behaviour when designing and modifying specific and general policies that encourage entrepreneurship in their jurisdictions; (ii) the policy focus needs to shift from EFCs to entrepreneurial attitudes and behaviour since cultivating the latter that promote economic growth is key to sustaining such growth.

While the study generated interesting results, its limitations include the fact that, first, it only considers the BRICS economies (a small sample) and the results may not be generalised to other developing countries. It is thus recommended that it be extended by incorporating other developing and emerging countries to gain more insight on the impact of entrepreneurial attitudes and behaviour, and EFCs on economic growth in these economies. Second, the study used a limited number of variables and fixed effects regression to assess the relationship between entrepreneurship and economic growth. Further entrepreneurial behaviour and attitudes and EFCs variables proposed by the GEM could be incorporated into the analysis and more sophisticated models could be employed to enhance their forecasting abilities. Third, some variables had missing data. We used mean imputation to resolve this challenge. Several data imputation techniques can be employed, especially the more complex ones, to check the effect of different data imputation techniques on the results. Fourth, the study did not consider the effect of the 2007–2009 economic and financial crisis and the COVID-19 pandemic on the results. Entrepreneurship's impact on economic growth in the context of crisis periods could be examined in the future.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

The data employed in this study is publicly available on the GEM website.

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