

Article

The Role of Financial Sector Development and Educational Attainment in the Achievement of Economic Sustainability: Evidence from BRICS Economies

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Abstract: The worldwide serious deteriorations in environmental and social quality have led many countries to follow institutional, social, and economic policies eliminating the negative environmental and social costs of economic growth and development, urbanization, and population growth. This study investigates the influence of financial sector development and educational attainment on economic sustainability in a sample of BRICS economies over the 1995–2020 term through causality and cointegration tests. The results of the causality test find a bidirectional causal interplay between financial development and economic sustainability and a unilateral causal effect from educational attainment on economic sustainability. Furthermore, cointegration analysis unveils a long-term positive influence of financial development and educational attainment on economic sustainability, but the effect of educational attainment on economic sustainability is ascertained to be slightly higher when compared with that of financial sector development. As a result, both educational attainment and financial development with environmental and social measures can be useful instruments to achieve economic sustainability.

Keywords: economic sustainability; financial sector development; educational attainment; BRICS economies; panel data analysis



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1. Introduction

The world has experienced remarkable rates of economic growth and welfare gains mainly driven by technological progress and globalization, but these have been accompanied by considerable environmental and social costs, such as air and water pollution, climate change, drought, biodiversity decreases, resource depletion, deforestation, income inequality, and poverty. Therefore, this has raised concerns about the future of the world and sustainability. The United Nations (UN) has pioneered studies and policies about sustainable development since the late 1940s with the formation of the International Union for the Protection of Nature [1], and in 1972 at the UN Conference on the Human Environment in Stockholm, the concept of sustainable development as a term with interrelated economic, environmental, and social dimensions was implicitly suggested [1]. To date, many national and worldwide initiatives and measures have been taken to combat environmental and social problems.

Sustainable development is a multidimensional concept and defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” by the UN [2]. Therefore, the main goal of sustainable development is to counterbalance the development between current and future generations. In this

context, 17 SDGs (sustainable development goals) intending to make progress in human development and economic, environmental, and social sustainability were accepted by the UN member states and came into force as of January 2016 [2]. As a result, countries have sought to achieve these SDGs with national, regional, and international supportive policies.

In empirical studies, scholars have predominantly concentrated on factors underlying environmental sustainability, whereas other dimensions of sustainable development have been investigated by relatively few scholars. Many economic, social, and institutional factors have been suggested to be significant for environmental sustainability, such as GDP, human capital, financial development, energy consumption, renewable energy consumption, technological progress, ICT development, population, trade, trade and financial openness, remittances, foreign direct investments, and institutional quality [3–6]. However, relatively few researchers have explored the factors underlying sustainable development and economic and social sustainability overall. Per capita income, human development, population, age structure, financial development, health expenditures, governance, government size, inflation rate, natural resource rent, and globalization have been identified as significant determinants of sustainable development [7,8].

Economic sustainability reflects the economic systems that achieve long-term economic growth by fostering environmental and social sustainability [9]. Therefore, factors affecting the environmental and social sustainability suggested by [3–8] are also sources of economic sustainability. In this study, we focus on the influence of education and financial sector development on economic sustainability, as they are key factors for sources of economic sustainability such as human capital and development, entrepreneurship, innovation, technological progress, ICT development, and renewable energy production. This means that educational attainment and financial sector development can simultaneously influence economic sustainability and multiple SDGs.

The financial sector performs a key role in the achievement of economic sustainability. The efficient functioning of the financial system is a significant factor in economic sustainability through efficiently mobilizing funds, managing risk and information, promoting innovation, fostering technological development, and enhancing productivity [8,10–12]. As a result, financial development can contribute to the achievement of economic sustainability through these diverse channels.

Educational attainment is a significant determinant for human capital and technological development, which are in turn considerable determinants for economic growth. In this context, educational attainment can influence economic sustainability through labor productivity, innovation, competitiveness, technological progress, environmental awareness, foreign direct investments, and labor market participation [13–15].

The aim of this paper is to study the influence of financial sector development and educational attainment on economic sustainability in all BRICS (Brazil, Russia, India, China, and South Africa) economies, drivers of the global economy during the past forty years. As of 2021, the BRICS countries made up 41.03% of the world's population with 3.23 billion people, 29.50% of the world's land area, 25.56% of the world's real GDP based on constant 2015 USD, and 18.10% of global trade [16–20]. In 2022, in terms of overall sustainable development, the Russian Federation, Brazil, China, South Africa, and India ranked 45th (SDG index: 74.1), 53rd (SDG index: 72.8), 56th (SDG index: 72.4), 108th (SDG index: 63.7), and 121st (SDG index: 60.3), respectively, out of 163 countries [21]. However, despite these rankings (upper middle and below middle from the global perspective), these countries have made significant progress in sustainable development. Likewise, the BRICS economies have ranked similarly in educational attainment and financial sector development [22,23], although they have shown a remarkable performance in both areas during the past three decades. This progress, as well as the potential for future progress in sustainable development, educational attainment, and financial sector development in the BRICS countries, has motivated us to analyze the interaction among three variables in sample of BRICS countries, rather than other economic and regional groups.

In the literature, scholars have predominantly investigated the influence of financial development and educational attainment on economic growth proxied by GDP or GDP per capita and disregarded the environmental and social costs and resource and forest depletion as seen in the empirical literature review. On the other hand, scholars investigating the interplay among financial sector development, educational attainment, and sustainability have generally focused on the environmental effects of financial sector development and educational attainment and the influence of education for sustainable development through sustainable awareness and behaviors of the individuals as seen in the empirical literature review. Therefore, to address the gap in the empirical literature, we analyze the influence of educational attainment and financial sector development on economic sustainability proxied by adjusted net savings. This study will also be one of the first to analyze the nexus among educational attainment, financial sector development, and economic sustainability in the sample of BRICS economies. The next section summarizes the available literature regarding the interplay among sustainability, financial development, and educational attainment. Section 3 defines dataset and econometric tests utilized in the current research, and Section 4 applies the econometrics tests and discusses the results. The article then arrives at the conclusion with Section 5.

2. Theoretical and Empirical Literature Review

The theoretical considerations about the interplay between financial development and economic growth differ. On the one hand, it is suggested that finance does not lead to economic growth but reacts to the real sector's demands [24–26]. On the other hand, it is suggested that finance is, in fact, a significant determinant of economic growth [10,27–32]. In this context, financial development can influence long-term economic growth through savings rates, investment decisions, and technological progress by decreasing the information and transaction costs and easing the external financing constraints of firms [32]. Furthermore, educational attainment is also suggested as a significant determinant of economic growth through human capital, entrepreneurship, innovation, research and development, technological development, and productivity in the context of endogenous growth theories [26,33–35]. In this context, Lucas [26] and Romer [34] suggested the human capital as one of the main determinants of economic growth and education could foster human capital through increasing the productivity. Furthermore, entrepreneurship, research and development, innovation, and technological development are also suggested as significant factors underlying economic growth by endogenous growth theories, and education can also influence the economic growth through these variables [28,34,36–39].

As a result, both financial sector development and educational attainment are theoretically expected to influence economic sustainability through human capital, entrepreneurship, innovation, technological progress, and productivity.

The finance sector has expanded globally during the past four decades, owing to globalization, financial liberalization, technological progress, and developments in the telecommunication sector. Therefore, the researchers have extensively studied the effects of financial development (or the stability, access, depth, and efficiency of the financial sector) on economic growth and other economic variables in the literature. The recent literature summary in Table 1 shows that the scholars have determined that financial development and its main dimensions proxied by domestic credit to the private sector, M1, M2, liquid liabilities, IMF's financial development index, stock market development, stock market indicators, and Morgan Stanley Capital International Index have mainly had a positive influence on economic growth and development [40–52]. Furthermore, the studies about the finance–economic growth relationship in the sample of BRICS economies have also revealed a positive impression of financial sector development on economic growth [41,43,51]. However, Cheng et al. [44] and Shahbaz et al. [46] revealed a negative influence of financial sector development on economic growth, and Selvasundaram et al. [51] disclosed an inverted U interplay between them. Furthermore, Ben Jedidia et al. [40], Nguyen et al. [49], and Çetin et al. [52] discovered a bilateral causal interplay between economic growth and

financial sector development, but Erkişi [41] determined a unilateral causal relationship. The empirical results are thus mixed in parallel with the theoretical considerations, but the differences have resulted from country-specific characteristics, methodological approaches, and different study periods.

Table 1. Recent literature about nexus of finance–economic growth.

Study	Sample/Period	Method	Impact of Financial Sector Development on Economic Growth
Ben Jedidia et al. [40]	Tunisia; 1973–2008	ARDL approach	Positive; bilateral causal interplay between two variables
Erkişi [41]	BRICS economies, 1996–2016	Westerlund cointegration test	Positive; unilateral causal relationship
Nasir et al. [42]	Korea, Philippines and Thailand; 1976–2015	Cointegration and causality tests	Positive in Korea and Thailand
Guru and Yadav [43]	BRICS economies; 1993–2014	Regression	A positive influence of banks and stock markets on economic growth
Cheng et al. [44]	72 countries, 2000–2015	Regression	A negative influence regardless of the national income level
Boikos et al. [45]	80 countries, 1973–2005	Quantile regression	A positive influence of financial reforms and financial development on economic growth
Shahbaz et al. [46]	Top 10 financially developed countries; 1971–2016	Threshold autoregressive distributed lag	Positive in Singapore; negative in Finland in the upper regime; positive in Australia and Singapore in the middle regime; negative in the US, Malaysia, and Singapore in the lower regime
Poghosyan [47]	7 Caucasus and Central Asian countries; 1993–2019	Regression	Positive
Nguyen [48]	25 transition economies; 1995–2019	Regression	Positive
Nguyen et al. [49]	22 emerging economies; 1980–2020	Dynamic common correlated estimator	Positive and a bilateral causal interplay between two variables
Abbas et al. [50]	44 lower- and upper-middle-income countries; 1995–2018	Panel ARDL	Positive in both income group countries
Selvasundaram et al. [51]	BRICS economies; 1980–2019	Westerlund cointegration test	An inverted U interplay between two variables
Çetin et al. [52]	33 developing countries; 1983–2019	CS-ARDL and Dumitrescu–Hurlin causality test	A bidirectional causality

The influence of financial development on the main components of sustainable development has also been investigated by many researchers, but the researchers have usually explored the influence of financial sector development on environment sustainability proxied by CO₂ emissions, greenhouse gas emissions, ecological footprint, and environmental performance indicators [53–69]. The recent empirical literature about the relationship between financial sector development and environmental degradation is given in Table 2, but the literature has been inconclusive. On the one hand, Shahbaz et al. [53], Habiba and Xinbang [65], and Pei et al. [67] found a negative influence of financial sector development on environmental quality, but Bui [57], Bayar et al. [58], Dong and Akhtar [59], Xu et al. [61], Musah et al. [63], Ozturk and Ullah [66], and Qalati et al. [68] found a positive influence. Furthermore, Ntow-Gyamfi et al. [56] and Wang et al. [64] revealed an inverted U interplay between environmental degradation and financial development. The different results of empirical studies can be attributed to the countries' different characteristics, such as human capital, institutional quality, governance, and economic development, which can influence the interplay between financial development and environmental quality. Furthermore, the mixed findings have also resulted from the differences in study period and methodological approach, because some researchers such as Dong and Akhtar [59], Wang et al. [64], and Xiang et al. [69] have reached mixed findings for the same country and country groups.

Table 2. Recent literature about the nexus between finance–environment.

Study	Sample/Period	Method	Impact of Financial Sector Development on Environmental Degradation
Shahbaz et al. [53]	Malaysia; 1971–2011	ARDL approach	Negative
Li et al. [54]	102 countries; 1980–201	GMM estimation	A mutual positive interaction between financial sector development and environmental quality
Ahmad et al. [55]	China; 1980–2014	Nonlinear ARDL	Positive
Ntow-Gyamfi et al. [56]	African countries; 1990–2016	Regression	An inverted U interplay between two variables
Bui [57]	100 countries; 1990–2012	Regression	Positive
Bayar et al. [58]	11 post-transition EU members; 1995–2017	Panel cointegration and causality tests	Positive
Dong and Akhtar [59]	China; 1990–2018	ARDL approach	Positive
Bădîrcea et al. [60]	Romania; 1995–2018	Regression	Positive
Xu et al. [61]	34 European countries; 2000–2020	Regression	Positive
Liu et al. [62]	E7 countries; 1990–2018	Cross-sectional autoregressive distributed lag	Positive
Musah et al. [63]	West African countries; 1990–2016	Cross-sectional autoregressive distributed lag	Positive
Wang et al. [64]	China, 2018–2019	Regression	An inverted U shaped nonlinear interplay between environmental quality and financial sector development.
Habiba and Xinbang [65]	46 developed and emerging countries; 2000–2018	GMM estimation	Negative
Ozturk and Ullah [66]	42 One belt and road initiative countries; 2007–2019	Regression	Positive
Pei et al. [67]	Japan; 1995–2020	ARDL	Negative
Qalati et al. [68]	Developed and developing economies; 1990–2019	Nonlinear ARDL	Positive
Xiang et al. [69]	China; 2000–2017	Regression	Bank competition increases the carbon emissions via investments and decreases the carbon emission through technological progress.

However, the direct effect of financial sector development on other dimensions of sustainable development, such as economic sustainability and human and social development, have been explored by relatively few scholars, and the limited empirical studies have obtained different results. Within this scope, Pardi et al. [7] explored the determinants of sustainable development proxied by adjusted net savings in Malaysia over the 1971–2011 period through a Johansen cointegration test and revealed a positive effect of financial sector development on sustainable development in the short and long term.

Houda and Lamia [70] studied the influence of financial sector development on main dimensions of sustainable development in 20 developing countries for the 1995–2011 term via a regression method and reached the conclusion that financial development had a positive influence on environmental sustainability but a negative influence on economic growth and industrial investment. Furthermore, Adams and Klobodu [71] studied the impact of financial sector development on sustainable development in West Africa for the 1981–2011 period via regression and discovered that financial development fostered sustainable economic growth but also increased the carbon dioxide emissions.

Ntarmah et al. [72] analyzed the influence of banking sector stability on economic sustainability proxied by adjusted net savings in 37 developing countries for the 2000–2016 term through a regression approach and discovered that z-scores of banking sector-scores had a positive impact on economic sustainability, but bank credit and regulatory capital had a negative impact. Koirala and Pradhan [8] also analyzed the factors underlying sustainable development proxied by adjusted net savings in 12 Asian economies over the 1990–2014 period through a regression approach and uncovered a positive influence.

Hunjra et al. [73] studied the effect of financial sector development on sustainable development in 50 low- and middle-income countries for the 1991–2020 duration through

regression analysis and found that financial development positively affected the sustainable development. Dutta and Saha [74] analyzed the causal interplay between sustainable development proxied by adjusted net savings and financial development in 143 countries over the 1990–2020 period using the PVAR method and uncovered a unidirectional causal relationship from financial sector development to sustainable development but a bilateral causal interplay between financial market index and sustainable development. Finally, Manigandan et al. [75] investigated the economic and environmental impacts of financial development in BRICS economies for the 1990–2020 duration through cointegration and causality tests and discovered a positive influence of financial development on per capita economic growth but a negative environmental influence of financial development.

A similar trend to the finance–growth interaction is seen in the empirical literature regarding the educational attainment and economic growth nexus. Most of the researchers have examined the influence of educational attainment, higher education, and a variety of educational variables on economic growth proxied by the growth rate of GDP and GDP per capita and usually reached a positive effect of educational attainment on economic growth, as shown in Table 3. However, the literature has ignored the possible negative environmental and social effects of economic growth by using the growth rate of GDP and GDP per capita.

Table 3. Recent literature on the relationship between educational attainment and economic growth.

Study	Sample/Period	Method	Impact of Educational Attainment on Economic Growth
Marquez-Ramos and Mourelle [14]	Spain; 1971–2013	Smooth transition regression	Positive
Sebki [15]	40 developing countries; 2002–2016	Regression	Positive (tertiary education); negative (secondary education)
Triyani [76]	Indonesia, 1980–2017	Granger causality test	Causal relationship from higher education to economic growth
Maneejuk and Yamaka [77]	ASEAN-5 economies; 2000–2018	Nonlinear regression	Positive
Qi et al. [78]	China; 1980–2010	Nonlinear ARDL	Positive
Ziberi et al. [79]	North Macedonia; 1917–2020	Regression	Positive
Chowdhury [80]	Australia; 1974–2019	Cointegration	Positive
Coman (Nuță) et al. [81]	11 new EU members; 1990–2020	ARDL with structural break	Mixed
Artige and Cavenaile [82]	United States of America; 1960–2010	Regression	Public education expenditures are a significant determinant of economic growth.

The studies on the nexus between educational attainment and sustainable development are limited compared with the ones on the education–growth nexus. However, scholars have broadly examined the effects of educational attainment on environmental sustainability, sustainable awareness, and behaviors of individuals (e.g., see [83–88]).

In this context, Sart [89] examined the effect of tertiary education on sustainable development in the 11 new EU member states for the period of 2000–2019 via cointegration and causality tests and attained a result that tertiary education had a positive influence on overall sustainable development. Ojike et al. [90] studied the impact of various educational indicators on sustainable development proxied by adjusted net savings in Nigeria over the 1990–2018 duration through the ARDL method and uncovered a positive impact of education on sustainable development in the short and long term.

Based on the theoretical and empirical literature review, our research question is the following:

What is the role of financial sector development and educational attainment in economic sustainability?

In this context, the study hypotheses are as following:

Hypothesis 1. *There is a significant relationship between financial development and economic sustainability.*

Hypothesis 2. *There is a significant relationship between educational attainment and economic sustainability.*

This study examines the role of financial sector development and educational attainment in the achievement of economic sustainability in the sample of BRICS countries. First, BRIC (Brazil, Russia, India, and China) was formed in 2006 to enter negotiations about economic, political, security, and cultural issues and then was named BRICS in 2010 after the acceptance of South Africa's full membership [91]. In this context, BRICS countries have had 14 meetings by the end of 2022 [92], and the following steps have been launched to improve the economic, social, cultural, and political relations among member states [91]:

- The New Development Bank was established in 2015 by BRICS economies to mobilize the resources for infrastructure and sustainable development projects in BRICS and other emerging market and developing countries.
- A treaty for the establishment of a BRICS Contingent Reserve Arrangement was signed in 2014.
- The BRICS Inter-Governmental Agreement on Cooperation in the Field of Culture was signed in the 2015 summit.
- The MOU (Memoranda of Understanding) on the establishment of the BRICS Agricultural Research Platform and the Cooperation Between the BRICS Diplomatic Academies were signed in the 2016 summit.

The BRICS countries have a significant force in the global economy in terms of population, production, raw materials, and energy sources. However, as shown in Table 4, the main characteristics of these countries differ remarkably. China and India have considerably much larger populations than the other members of BRICS, but China is far ahead of India in terms of economic size. Russia, South Africa, China, and Brazil converge in economic development (GDP per capita), social development (human development index), and education level (mean years of schooling), but India lags far behind these countries. However, economic freedom levels are relatively close to each other among the countries.

Table 4. Main characteristics of BRICS countries.

Characteristics	Brazil	China	India	Russia	South Africa
Population (2021)	214,326,223	1,412,360,000	1,407,563,842	143,449,286	59,392,255
Real GDP (constant 2015 USD) (billion, 2021)	\$1829.90	\$15,801.91	\$2726.37	\$1490.19	\$353.26
Real GDP per capita (constant 2015 USD) (2021)	\$8537.94	\$11,188.30	\$1936.94	\$10,216.25	\$11,011.13
Human development index (2021)	0.754	0.768	0.633	0.822	0.713
Mean years of schooling (2021)	8.1	7.6	6.7	12.8	11.4
Economic freedom index (2020)	6.33	6.27	6.72	6.62	6.55

Source: World Bank [16,18,93], UNDP [22], Fraser Institute [94].

The intra-trade among BRICS members has increased steadily its establishment, as seen in Table 5. In this regard, intra-group exports and imports were USD 496,966.30 million and USD 707,806.42 million, respectively.

Table 5. Intra-group trade statistics of BRICS countries (current USD prices in millions) (2006–2021).

Year	Intra-Group Export	Intra-Group Import
2006	92,891.69	182,840.10
2007	128,620.76	234,901.66
2008	168,959.13	300,523.25
2009	144,430.09	258,474.29

Table 5. *Cont.*

Year	Intra-Group Export	Intra-Group Import
2010	210,712.91	353,942.96
2011	274,920.58	458,949.93
2012	281,390.79	494,395.75
2013	296,390.97	516,459.07
2014	295,355.78	506,625.56
2015	243,561.93	445,089.26
2016	238,006.91	414,043.14
2017	297,808.70	483,537.42
2018	352,279.48	551,427.70
2019	355,587.21	535,403.33
2020	340,264.70	514,083.83
2021	496,986.30	707,806.42

Source: UNCTADSTAT [95].

Tourism is another instrument to increase the cooperation among BRICS nations, and tourism was accepted as a strategic sector in 2012. Since 2013, the BRICS Delhi Declaration and Action plan and BRICS Tourism Ministers have held regular meetings to improve cooperation in the tourism sector [88]. However, the figures on arrivals of visitors at national borders in Table 6 indicate that there exists a strong relationship between China and Russia and between China and India in the tourism sector. Nevertheless, there is great potential for the mutual relations in the tourism sector among BRICS countries to improve in the upcoming years.

Table 6. 2018 Arrivals of visitors at national borders to BRICS countries (in thousands).

Home Countries of Visitors	Tourist Receiving Country				
	Brazil	China	India	Russia	South Africa
Brazil	-	118.8	26.6	68.9	77.1
China	56.3	-	281.8	1690.2	100.3
India	16.7	708.5	-	85.7	99.7
Russia	19.2	2414.3	262.3	-	18.2
South Africa	21.3	83.6	58.6	15.4	-

Source: UNWTO [96].

3. Data and Methods

The goal of this research is to analyze the influence of financial sector development and educational attainment on economic sustainability in the BRICS economies for the 1995–2020 period through panel causality and cointegration tests. In the empirical analysis, economic sustainability is proxied by adjusted net savings (ANS) (% of gross national income [GNI]) which is measured by net national savings plus education expenditures and minus carbon dioxide and particulate emissions damage, energy depletion, net forest depletion, and mineral depletion [97]. Financial sector development (FINDEV) is proxied by the financial development index of IMF [23] by Svirydzenka [98]. (Financial development index is produced by taking note of the depth, access, and efficiency of financial systems, unlike the other proxies of financial development, and obtains values between 0 and 1 [98]). Educational attainment (EDUC) is represented by the education index of UNDP [22], and the education index is generated by the sum of expected and mean schooling years (see technical notes for detailed information about education index in UNDP [99]).

The series are annual, and the period of the data is specified as 1995–2020, because the ANS data are available as of 1995 and over in 2020. The econometric tests are carried out by Stata 15.0, EViews 12.0, and Gauss 12.0.

The descriptive statistics of the ANS, FINDEV, and EDUC are reported in Table 7. The average value of ANS is 10.164%, and the averages of the financial development index and education index are 0.49 and 0.615, respectively. However, ANS displays a significant variation in the panel, whereas there is much less variation in the series of FINDEV and EDUC. In this context, China and India have relatively much higher ANS as a percent of GDP when compared with Brazil, Russia, and South Africa. The financial development of BRICS countries is very similar. Moreover, Russia, South Africa, and Brazil have respectively higher education levels than China and India.

Table 7. Statistical summary of the series.

Statistics		ANS	FINDEV	EDUC
Mean		10.164	0.490	0.615
Median		9.442	0.476	0.614
Maximum		27.593	0.672	0.864
Minimum		−25.322	0.325	0.336
Std. Dev.		9.704	0.092	0.133
Skewness		−0.593	0.223	−0.126
Kurtosis		3.882	1.988	2.310
Brazil	Mean	7.603	0.526	0.613
	Median	7.361	0.594	0.601
	Maximum	10.60	0.661	0.702
	Minimum	2.582	0.323	0.511
	Std. Dev.	2.232	0.113	0.057
	Skewness	−0.287	−0.505	0.216
	Kurtosis	−0.791	−1.324	−1.018
China	Mean	21.446	0.490	0.540
	Median	21.183	0.495	0.547
	Maximum	27.59	0.67	0.65
	Minimum	16.03	0.35	0.42
	Std. Dev.	3.341	0.104	0.074
	Skewness	0.277	0.237	−0.133
	Kurtosis	−0.845	−1.378	−1.268
India	Mean	17.915	0.429	0.448
	Median	18.890	0.421	0.446
	Maximum	23.04	0.52	0.55
	Minimum	12.68	0.37	0.34
	Std. Dev.	3.524	0.031	0.076
	Skewness	−0.305	0.873	0.041
	Kurtosis	−1.386	1.613	−1.513
Russia	Mean	2.658	0.475	0.791
	Median	6.811	0.482	0.795
	Maximum	13.45	0.57	0.86

Table 7. Cont.

Statistics		ANS	FINDEV	EDUC
South Africa	Minimum	−25.32	0.33	0.68
	Std. Dev.	10.419	0.064	0.052
	Skewness	−1.535	−0.849	−0.688
	Kurtosis	1.413	0.321	−0.299
	Mean	1.199	0.529	0.678
	Median	1.3454	0.549	0.675
	Maximum	4.80	0.64	0.76
	Minimum	−2.16	0.35	0.61
	Std. Dev.	2.217	0.082	0.047
	Skewness	0.093	−0.487	0.016
	Kurtosis	−1.199	−0.481	−1.157

The short-run interplay among economic sustainability, financial sector development, and educational attainment is studied with a Dumitrescu–Hurlin [100] causality test. The test produces more consistent results in case of heterogeneity and cross-sectional dependence among the series and can be performed when the time dimension of the dataset is lower or higher than the cross-section dimension of the panel dataset. The Dumitrescu–Hurlin [100] causality test follows Equation (1) to examine the interplay between two stationary variables of x and y :

$$y_{i,t} = \alpha_i + \sum_{k=1}^k \gamma_i^{(k)} y_{i,t-k} + \sum_{k=1}^k \beta_i^{(k)} x_{i,t-k} + \varepsilon_{i,t} \quad (1)$$

The null hypothesis (non-causality from x to y) is tested by average of individual Wald statistics in Equation (2):

$$W_{N,T}^{Hnc} = \frac{1}{T} \sum_{i=1}^B W_{i,T} \quad (W_{i,T} : \text{individual Wald statistics}) \quad (2)$$

In this case, asymptotic test statistic ($Z_{N,T}^{Hnc}$) ($T > N$) and semi-asymptotic test statistic (Z_N^{Hnc}) ($N > T$) should be considered depending on time and cross-section dimensions of the panel dataset.

$$Z_{N,T}^{HNC} = \sqrt{\frac{N}{2K}} (W_{N,T}^{HNC} - K) \quad T, N \rightarrow \infty, N(0,1) \quad (3)$$

$$Z_N^{HNC} = \frac{\sqrt{N} [W_{N,T}^{HNC} - N^{-1} \sum_{i=1}^N E(W_{i,T})]}{\sqrt{N^{-1} \sum_{i=1}^N Var(W_{i,T})}} \quad N \rightarrow \infty, N(0,1) \quad (4)$$

The cointegration interplay among economic sustainability, financial sector development, and educational attainment is studied with Westerlund and Edgerton [101] cointegration analysis, taking notice of cross-sectional dependence. This test takes account of cross-sectional dependence, autocorrelation, and heteroscedasticity while studying the cointegration interplay among financial development, educational attainment, and economic sustainability and produces more consistent results if the sample size is small [101]. The cointegration interplay among the series is derived from Equation (5):

$$y_{it} = \alpha_i + x_{it}\beta_i + z_{it} \quad (5)$$

In Equation (5), i (BRICS economies) = 1, 2, ..., 5 and t (years) = 1995, 1996, ..., 2020 and $z_{it}(\text{error term}) = u_{it} + v_{it}$ and $v_{it} = \sum_{j=1}^t \eta_{ij}$ (η_{ij} is error term having statistics of normal distribution, zero average, and σ_i^2 variance). The null hypothesis of the cointegration test claims the subsistence of significant cointegration interplay among financial development, educational attainment, and economic sustainability. The cointegration coefficients of the countries and whole panel are determined by the AMG (Augmented Mean Group) estimator of Eberhardt and Teal [102] and Bond and Eberhardt [103]. The AMG estimator is a heterogeneous estimator and gets robust results in cases of cross-section dependence.

4. Econometric Results and Discussion

In the applied part of the paper, cross-section dependence and homogeneity tests are conducted to see the characteristics among financial development, educational attainment, and economic sustainability through LM_{adj.}, LM CD, LM, and delta tilde tests. The probabilities of cross-sectional tests in Table 8 are found to be lower than 5%. Therefore, the H0 hypothesis of cross-section independence is rejected and the existence of cross-sectional dependence among the series of ANS, FINDEV, and EDUC is uncovered. As a result, there exists a mutual interaction in all BRICS states in terms of economic sustainability, financial development, and educational attainment owing to the close economic relations and highly globalized world. The probabilities of the homogeneity test are found out to be less than 5%; thus, the availability of homogeneity is refuted, and the subsistence of heterogeneity is unveiled.

Table 8. Consequences of cross-sectional dependency and heterogeneity tests.

Tests of Cross-Sectional Dependence		
Test	Test Statistics	<i>p</i> Value
LM _{adj.}	37.823	0.007
LM CD	39.401	0.015
LM	41.336	0.004
Tests of Homogeneity		
$\tilde{\Delta}_{adj.}$	28.067	0.000
$\tilde{\Delta}$	26.731	0.002

The entity of unit root in the series of financial development, educational attainment, and economic sustainability should be determined before conducting the causality and cointegration tests. Therefore, unit root analysis is implemented through the CIPS unit root test by Pesaran [104], taking notice of cross-sectional dependence among economic sustainability, financial development, and educational attainment. The test results in Table 9 show that the H0 hypothesis (entity of unit root) is accepted for level values of the variables, but the null hypothesis is rejected for first differences of ANS, FINDEV, and EDUC. Thus, the integration levels of ANS, FINDEV, and EDUC are revealed to be one. In other words, these three variables have become stationary after first-differencing.

Table 9. Consequences of CIPS test.

Variables	Constant	Constant + Trend
ANS	−0.945	−1.062
D(ANS)	−7.347 **	−8.503 **
FINDEV	−1.198	−1.278
D(FINDEV)	−8.416 **	−9.102 **
EDUC	−0.866	−0.970
D(EDUC)	−7.101 **	−8.215 **

** significant at 5%.

The long-run interplay among economic sustainability, financial development, and educational attainment is studied with a Westerlund and Edgerton [101] cointegration test, and the test results are exhibited in Table 10. Both asymptotic and bootstrap probability values are revealed to be higher than 5%. Therefore, a significant cointegration interplay among economic sustainability, financial development, and educational attainment is discovered in the light of cointegration test results.

Table 10. Consequences of panel cointegration test.

Test Statistic	Constant		Test Statistic	Constant + Trend	
	Asymptotic <i>p</i> -Value	Bootstrap <i>p</i> -Value		Asymptotic <i>p</i> -Value	Bootstrap <i>p</i> -Value
8.233	0.314	0.389	9.103	0.416	0.511

Note: The bootstrap critical values are obtained through 10,000 repetitions.

The cointegration coefficients of countries and the whole panel are identified through an AMG estimator, and the coefficients are presented in Table 11. The panel coefficients uncover that both financial development and educational attainment have a positive effect on economic sustainability in the long term. However, the effect of educational attainment on economic sustainability is slightly larger than that of financial development. The financial sector development and educational attainment together explain the 21% of the variation in economic sustainability. However, total influence of both variables on economic sustainability can differ among the BRICS states. The cointegration coefficients of BRICS nations indicate that both financial development and educational attainment have a positive influence on economic sustainability in all BRICS economies. The financial development index in Table 12 indicates that Brazil, China, and South Africa have especially attained more success in financial sector development during the 1995–2020 period, and, therefore, their long-run coefficients about the effects of financial sector development on economic sustainability are slightly larger. Furthermore, all BRICS nations have achieved considerable progress in educational attainment, and thus the effects of educational attainment on economic sustainability are higher in comparison to financial sector development in all BRICS states.

Table 11. Estimation consequences of cointegration coefficients.

Countries	FINDEV	EDUC
Brazil	0.122 ***	0.149 **
China	0.147 ***	0.187 ***
India	0.082 ***	0.153 **
Russia	0.078 ***	0.168 ***
South Africa	0.133 **	0.154 ***
Panel	0.099 ***	0.112 ***

***, ** indicate that it is significant at 1% and 5%, respectively.

Table 12. Financial development and education index in the BRICS states.

Countries	Year	Financial Development Index	Education Index
Brazil	1995	0.3249	0.5142
	2020	0.6622	0.7043
China	1995	0.3481	0.4164
	2020	0.6718	0.6488
India	1995	0.3666	0.3363
	2020	0.5158	0.5517
Russia	1995	0.3319	0.6803
	2020	0.5305	0.8638
South Africa	1995	0.3461	0.6341
	2020	0.6215	0.7581

Source: [22,23].

There have been two opposite theoretical considerations about the interplay between financial development and economic growth. In this context, one view suggests a significant relationship between real economy and financial sector development [24–26]. However, the other view suggests that the financial sector development is a significant determinant of long-term economic growth via encouraging savings rates, investment decisions, and innovation and technological progress [10,27–32]. However, these theoretical considerations do not account for the negative environmental and social effects accompanying the economic growth. Therefore, the net influence of financial development on economic sustainability varies depending on the composition of economic growth. The few empirical studies have reached mixed findings in line with these theoretical considerations. Pardi et al. [7], Koirala and Pradhan [8], Ntarmah et al. [72], and Hunjra et al. [73] revealed a positive effect of financial sector development on sustainable development. However, Adams and Klobodu [71] determined that, while financial development fostered sustainable economic growth, it also led to environmental degradation. Many other researchers, such as Shahbaz et al. [46], Bui [57], Bayar et al. [58], Dong and Akhtar [59], and Bădîrcea et al. [60] also discovered a negative influence of financial development on environmental quality. Therefore, our findings on the nexus between finance–economic sustainability are in accord with the results of Pardi et al. [7], Koirala and Pradhan [8], Ntarmah et al. [72], and Hunjra et al. [73].

Educational attainment can foster economic growth through multiple components of economic growth suggested by endogenous growth theories [26,33–35]. Moreover, the observed effects of educational attainment can be long lasting, consistent with the broadly established positive effects of human capital on economic growth [105–108]. However, the interplay between educational attainment and economic sustainability remains largely untouched in the literature. Within this scope, Sart [89] and Ojike et al. [90] uncovered a positive influence of educational attainment on sustainable development. Therefore, our results are compatible with the suggestions of endogenous growth theories and the findings of Sart [89] and Ojike et al. [90].

The causal association among economic sustainability, financial sector development, and educational attainment is examined with a Dumitrescu–Hurlin [100] causality test, and its results in Table 13 uncover a bilateral causal association between financial development and economic sustainability and a unilateral causal effect between educational attainment and economic sustainability. Theoretically, a mutual interplay among economic sustainability, financial development, and educational attainment is possible. However, only Dutta and Saha [74] empirically analyzed the causal interplay between sustainable development and financial development for a panel of 143 countries and uncovered a unidirectional causal effect from financial sector development to sustainable development but a bilateral causal association between financial market index and sustainable development. Furthermore, Sart [89] unveiled a unidirectional causal effect from higher education to sustainable development. Therefore, our findings are found to be in accord with the results of Dutta and Saha [74] and Sart [89].

Table 13. Consequences of causality analysis among environmental sustainability, financial development, and educational attainment.

Null Hypothesis	Test	Test Statistics	<i>p</i> -Value
D(FINDEV) \nrightarrow D(ANS)	Whnc	6.305	0.000
	Zhnc	6.998	0.000
	Ztild	7.104	0.000
D(ANS) \nrightarrow D(FINDEV)	Whnc	8.241	0.000
	Zhnc	8.607	0.000
	Ztild	9.056	0.000
D(EDUC) \nrightarrow D(ANS)	Whnc	7.365	0.000
	Zhnc	7.894	0.000
	Ztild	8.012	0.014

Table 13. Cont.

Null Hypothesis	Test	Test Statistics	<i>p</i> -Value
D(ANS) \nrightarrow D(EDUC)	Whnc	1.492	0.127
	Zhnc	2.102	0.312
	Ztild	2.598	0.388

Lastly, the results of both cointegration and causality tests support the study hypotheses which suggest a significant relationship among financial development, educational attainment, and economic sustainability.

5. Conclusions

The worldwide environmental and social degradation and the depletion of resources and forests have caused economic sustainability to be a vital factor for all countries. The UN has pioneered studies about sustainable development together with other international and regional organizations. All countries have also tried to achieve long-term economic growth without environmental, social, and cultural costs in line with 17 SDGs. These developments have also led researchers to explore the key factors underlying economic and environmental sustainability and human and social development.

The empirical literature has generally investigated the influence of financial sector development and educational attainment on environmental sustainability, and very few scholars have analyzed the impact of financial sector development and educational attainment on economic and social sustainability. Therefore, this paper studies the influence of financial sector development and educational attainment in the achievement of economic sustainability in a sample of BRICS economies over the 1995–2020 period via tests of causality and cointegration to fill the gap in the empirical literature. The causality test uncovers a bilateral causal interplay between economic sustainability and financial development and a unilateral causality from educational attainment to economic sustainability. In other words, there exists a mutual interplay between economic sustainability and financial development, and educational attainment has a significant impression on economic sustainability. The cointegration analysis points out a significant long-term positive influence of educational attainment and financial development on economic sustainability in all BRICS economies. However, the long-run influence of educational attainment on economic sustainability is found to be slightly greater than that of financial sector development, and this finding can result from educational attainment having the potential to influence economic sustainability through more channels such as human capital, entrepreneurship, research and development, innovation, and technological development. Our short and long-term findings are evaluated to be compatible with the related theoretical studies and the results of the limited literature. However, the great part of the empirical literature indicates that environmental degradation can accompany the positive growth effect of both financial development and educational attainment depending on country specific characteristics such as human capital and economic development level.

As a consequence, educational attainment and financial sector development can influence economic sustainability through diverse channels suggested by endogenous growth theories. Therefore, policies for improving the financial development and educational attainment can make a contribution to the economic sustainability as long as both educational attainment and financial sector development can be effective on these channels. In this context, education and economic policies focused on the improvement of main components of economic growth together with environmental and social measures should be utilized to foster economic sustainability. Future studies can separately analyze the effect of educational attainment and financial development through human capital and technological development on the main dimensions of sustainability.

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