

External Debt and Economic Growth of BRICS Nations: How can BRICS Integration help them?

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Abstract

This study examines the relationship between external debt and economic growth in the BRICS countries. It explores how BRICS integration can aid these economies and newly joined countries in solving the debt problem. Using the latest panel data techniques and country experiences, we employed the panel mean group method (PMG) and interrupted time series analysis (ITSA) for South Africa, who joined in 2010. Results show a negative relationship between external debt and economic growth at the group level, with mixed results for individual countries. Using individual country experiences, valid implications are drawn for debt-stressed countries like Ethiopia and oil-rich nations like Saudi Arabia. Integrating new member countries in BRICS can overhaul the existing system towards broader perspectives of reforms in global financial institutions. Integration into the BRICS association can benefit these countries through reforms in global financial institutions, fairer debt restructuring, joint investment projects, macroeconomic coordination, debt management knowledge sharing, innovative financing, and collective advocacy for debt relief to enhance stability and resilience.

Keywords

External debt, Economic growth, BRICS, Newly joined countries, Integration, PMG model

Аннотация

В данном исследовании рассматривается взаимосвязь между внешним долгом и экономическим ростом в странах БРИКС, а также вопрос о том, как интеграция БРИКС может помочь участникам организации, включая вновь присоединившиеся страны, в решении долговой проблемы. Используя новейшие методы работы с панельными данными и опыт стран, мы применили метод группового среднего значения (PMG) и анализ прерывистых временных рядов (ITSA) для Южной Африки, которая присоединилась к проекту в 2010 году. В исследовании впервые использовался метод группового среднего значения (PMG) и анализ прерывистых временных рядов (ITSA) для изучения влияния внешнего долга на экономический рост в странах БРИКС. Результаты показывают отрицательную связь между внешним долгом и экономическим ростом на уровне группы, при этом результаты по отдельным странам неоднозначны. Анализ опыта отдельных стран позволяет сделать выводы для экономик, испытывающих долговую нагрузку, таких как Эфиопия, и для стран, богатых нефтью, таких как Саудовская Аравия. Включение новых стран в БРИКС может вызвать перестройку существующей системы в сторону больших возможностей реформирования глобальных финансовых институтов. Интеграция в БРИКС может принести пользу этим странам благодаря реформам в глобальных финансовых институтах, более справедливой реструктуризации долга, совместным инвестиционным проектам, макроэкономической координации, обмену знаниями по управлению долгом, инновационному финансированию и коллективным выступлениям за облегчение долгового бремени, повышение стабильности и устойчивости.

Ключевые слова

внешний долг, экономический рост, БРИКС, вновь присоединившиеся страны, интеграция, модель PMG

JEL: F34, O40, O57, O53, F15, C23.

1. Introduction

The distinct impact of foreign debt liability on economic growth is a highly debated topic in macroeconomics. In the past two decades, global public finances have faced significant economic catastrophes, including the 2008 International financial crisis and the pandemic-driven global downturn. Governments worldwide responded with substantial financial guarantees and provisions to address the critical needs of private ventures and households (Dougherty & Biase, 2021). This monetary stimulus was primarily funded by significant government borrowing, resulting in a massive increase in public debt. In emerging nations, public debt reached \$11.5 trillion in 2021. According to an IMF study in 2022, \$400 billion was spent on debt servicing alone. Consequently, the World Economic Forum identified widespread country debt evasion as one of the significant global risks for the future.

Studying external debt within BRICS is crucial to understanding contemporary global economic dynamics. Representing more than 40% of the world's population and about one-fourth of the global GDP, the BRICS nations are pivotal players in the

international financial landscape (IMF, 2022). Their robust economic growth has driven global economic expansion, especially after the 2008 financial crisis. However, these countries face significant public and external debt burdens, with public debt ranging from 21% (Russia) to 92.68% (Egypt) and external debt from 15.7% (Russia) to 42.4% (Egypt) (World Bank, 2023). Monitoring their debt dynamics is essential for assessing the sustainability of their growth trajectories. These nations are attractive destinations for foreign investment thanks to their vast consumer markets, abundant natural resources, and rapidly expanding infrastructures (WEF, 2023). Effective external debt management is crucial for maintaining investor confidence and sustaining economic stability.

As significant exporters and importers, the BRICS nations play a crucial role in global trade flows. Their debt levels influence their ability to engage in international trade and manage fluctuations in commodity prices and currency exchange rates (WEF, 2023). Excessive external debt can pose systemic risks to the financial stability of these nations, potentially triggering economic downturns with far-reaching consequences. Newly joined countries like Ethiopia, Egypt, UAE, Saudi Arabia, and Iran add diversity in debt management, natural resources, and geopolitical issues. A multifaceted approach may help them mitigate some of their problems. Sustainable debt management is imperative for the BRICS countries' long-term financial stability and development. Balancing the need for financing with prudent fiscal policies is essential for avoiding debt distress and fostering sustainable growth (IMF, 2022).

External debt often has geopolitical implications, as the BRICS nations borrow from various bilateral and multilateral sources. Analyzing the terms and conditions of these loans provides insights into geopolitical alliances and power dynamics (Dougherty & Biase, 2021). Investments funded by external debt play a pivotal role in infrastructure development, enhancing competitiveness and fostering economic diversification. However, the effectiveness of these investments depends on their alignment with broader development objectives. The BRICS nations advocate the reforming of international financial institutions as these should reflect the evolving global economic landscape (WEF, 2023). Understanding their external debt dynamics is integral to addressing disparities in global governance and promoting a more inclusive financial architecture (IMF, 2022).

In the BRICS economies, a significant push for development originates from government-led investments. Even so, the average debt-to-GDP ratio of BRICS was 70.35% in 2020 (RBI, 2021), with Brazil having the highest debt obligation at nearly 100%, followed by India (89.6%), South Africa (69.5%), China (66.8%), and Russia (19.3%). Mismanagement of public debt in BRICS could have larger repercussions for the world economy (RBI, 2021).

Our research aims to examine the linkage between external debt and economic growth in the BRICS bloc over 26 years from 1994 to 2020. This study adds to contemporary literature by focusing on panel data from five major developing countries, whereas previous studies have primarily examined advanced economies like the United States. This research provides significant insights into how the

newly joined BRICS members manage fiscal constraints in the context of economic integration. It aims to contribute to the existing literature on external debt management and provide insights by highlighting the usefulness of economic integration.

However, this study is limited in its objective as it focuses on the external debt of the BRICS nations, not the domestic debt. Both types of debt are essential and complementary to each other. These countries face significant public debt burdens, for example, 81% in India and 92.78% in Egypt. Future studies should integrate both types of debt to develop more comprehensive solutions for debt-related problems of these economies. The remaining sections of this study are structured as follows: A literature review is presented in section II, followed by explanation of methodology in section III. Data analysis and findings are discussed in section IV. The final section V contains the conclusion and policy implications.

2. Literature Review

The literature on the impact of external debt on economic factors identifies three main channels through which external debt affects an economy: Debt Overhang, Liquidity Constraints, and Uncertainty Effects (Soydan & Bedir, 2015). The Debt Overhang Hypothesis suggests that increased external debt negatively affects physical capital investment, human capital investment, technological acquisition, and macroeconomic reforms (Claessens et al., 1996a, 1996b; Clements et al., 2003). High external debt puts pressure on the future fiscal space due to rising debt servicing and repayment obligations, which often leads to higher taxes, new levies, or austerity measures (Cohen, 1993; Claessens et al., 1996a, 1996b; Fosu, 1996; Pattillo et al., 2002, 2004; Clements et al., 2003; Arnone et al., 2005). Increased taxes reduce consumption, affecting overall demand, producer revenue, employment, capital investments, household income, and tax collections (Auerbach, 1997). Austerity measures also reduce spending on education and healthcare (Stuckler et al., 2017).

Increases in external debt also lead to volatility in future resource inflows and debt repayments, affecting macroeconomic stability. Higher debt levels lower the country's credit rating, which in turn raises borrowing costs, crowds out private investment and reduces household incomes, increasing poverty and worsening health indicators (Soydan & Bedir, 2015; Barro, 1979; Fawzy, 2002). Economic downturns caused by high debt levels disproportionately affect women, worsening gender equity imbalances (Marshall, 1985).

Financing fiscal deficits through domestic or external borrowing significantly impacts economic growth. Fiscal deficits are often used to stimulate economic activity during downturns (Amassoma, 2011; Khan et al., 2019). Budget deficits can have adverse effects in the short term but may have positive effects in the subsequent year. Expansionary fiscal policies promote growth in sluggish economies (Tanaka, 2022; Arjomand et al., 2017; Istiqomah & Mafruhah, 2022).

Empirical evidence consistently shows that while some level of borrowing can be beneficial, excessive external debt significantly hampers economic growth and stability. For instance, Kibona and Kima (2024) have found that external debt negatively impacts financial development in Africa. San and Chin (2023) show that government debt affects economic growth differently across developed and developing countries. In Sub-Saharan African countries, Agyeman et al. (2022) found that limited capital exacerbated the negative impact of external debt on economic growth. Augustine and Rafi (2023) observed significant variability in debt levels in emerging economies, with rising debt often exceeding permissible limits and hindering improvement.

Studies like those by Mencinger et al. (2015) in OECD countries demonstrate that low public debt levels positively impact growth, but high debt levels (above 90-94%) negatively impact it. Katsikas et al. (2023) found that in euro-area countries, debt instability begins to affect solvency when borrowing costs exceed 3.29%. In India, Singh and Kumar (2022) conclude that domestic debt positively impacts long-term growth, while external debt servicing hinders it. Overall, the consensus is that excessive external debt negatively affects economic performance, and managing debt effectively is crucial for sustaining economic growth and stability.

Governments globally resort to internal and external borrowing to consistently subsidize their monetary shortfalls. Global systemic risks like natural disasters, financial crises, sovereign debt defaults, health emergencies, and geopolitical tensions have marred the last three decades. These threats have strained public revenues, leading to a reliance on external borrowings to meet the rising demand for energy, food, healthcare, and infrastructure. Governments worldwide relied on substantial bailouts and financial stimulus packages to spur consumption and boost private investment. Extensive government debt-seeking programs drove the fiscal deficits.

Research work by Yashina et al. (2015) found a close association between a nation's debt and economic development, emphasizing that effective debt management is more important for economic growth than the size of the debt. Noga et al. (2018) demonstrated that low public debt levels did not necessarily translate into better economic development. Similarly, Wang et al. (2021) acknowledged that there was a negative association between outer obligation commitment and human improvement in BRICS countries from 1990 to 2016.

A study by Fosu (1996) concluded that countries facing tight fiscal space due to high debt servicing commitments tended to have a poor productive investment mix. High external debt servicing often leads to reckless investment decisions focused on quick returns rather than long-term investments that enhance the country's productive capacity. Additionally, high-debt servicing compromises productive investments, requiring costly imported materials for economic growth. These factors influence investment mix decisions, disrupting productive capacity and reducing economic growth. Under the "vulnerability" channel, an increase in external debt often triggers volatility in future resource inflows and debt repayments, directly affecting the country's macroeconomic stability. When the Government becomes more indebted, its

credit rating is downgraded, leading to higher costs of external debt (Soydan & Bedir, 2015).

Unreasonably high cost of capital crowds out private investment (Barro, 1979), reducing the number of people able to secure decent jobs (Fawzy, 2002). This withdrawal in average household incomes directly impacts poverty ratios and key healthcare pointers such as infant mortality rate, life expectancy, and death rate. These deteriorating economic conditions disproportionately affect women, further exacerbating gender equity imbalances (Marshall, 1985). The decision to fund the fiscal deficit through domestic or foreign borrowing can significantly impact economic growth (Amassoma, 2011). As measured by GDP, economic growth is a crucial channel that can directly affect a country's Human Development profile (Khan et al., 2019). Several studies demonstrate the link between economic growth and socio-economic indicators such as poverty, HDI, income levels, wealth inequality, life expectancy, and employment (Rawski, 1979; Muinelo-Gallo & Roca-Sagalés, 2011; Agrawal, 2007; Mahyar, 2016; Khan et al., 2019).

According to the pump-priming hypothesis, the Government's budgetary deficit is anticipated to fund overall economic activity and avert a profound recession. Generating job avenues through government policies to back its deficit can raise aggregate demand and spending power. Business tycoons will be motivated to increase production accordingly. Public spending programs could also result in increased overall demand. Keynesian economists argue that citizens perceive a rising trend in their after-tax income due to the Government's budget deficit approach, reinforced by tax reductions. Increased expenditure will raise the demand for goods and services, boosting pecuniary activity (Istiqomah & Mafruhah, 2022).

Although much research has been done on the macroeconomic effect of outside obligation, understanding its impact on financial factors remains to be expanded. Ayoub et al. (2024) have found that in the long haul, outer obligation emphatically influences joblessness and the future while adversely affecting the net national income. These findings are consistent in the short run, except for unemployment, which decreases with an increase in external debt.

External debt is a challenging issue (Allen, 2013). The allure of easy money traps the Government, leading to debt exceeding sustainable levels. This results in the country's weaknesses such as decelerating economic growth (Davydenko et al., 2023) or even catastrophes (Reinhart & Rogoff, 2010). A study using data from 1946-2009 found that if external debt exceeded 90% of GDP, the growth rate decreased. Alternately, the connection between external debt obligation and development weakens when foreign debt diminishes. Herndon et al. (2013) contend that the impact of such liability on economic progress remains the same above or below any threshold value in their study of the same period. They examined balanced panel data from 1980 to 2017 for 80 developing countries to explore evidence of debt overhang and liquidity effects on growth. Controlling for various factors affecting growth, they found evidence of debt overhang effects in emerging nations. When the ratio of external debt to GDP exceeds 55%, the impact on growth becomes negative and statistically significant. Using a fixed

effects panel threshold model, they revealed that such a negative association is more noticeable in upper-middle-income developing countries: high debt levels slow growth when the debt-to-GDP ratio surpasses certain thresholds.

Debt Obligation commitments gathered yearly make it progressively challenging for the public authority to avoid obligation bondage because of internal and external factors. As expenditures rise and incomes decline, the monetary shortage causes a bleak financial standpoint. The movement of obligation accentuates future ramifications. Carney et al. (2014) referred to a joke from Herbert Hoover: "Favoured are the youthful, for they will acquire the public obligation." There is a worry that the current generation is making debt obligation troubles for what is to come. Edi Harsono, Andi Kusumawati, and Nirwana (2024) analyzed the determinants of outside debt obligation and examined methodologies for overseeing it, considering factors like inflation rate, exchange rate, interest rate, exchange receptiveness, and institutional quality. Their review utilized regression analysis to investigate the association between institutional quality and macroeconomic markers on external obligation. They chose 52 examples from five ASEAN agricultural nations from 2008 to 2019, finding that inflation, loan fees, and institutional quality adversely influenced outer obligation, unlike exchange rate and exchange receptiveness.

Isubalew Daba, Avana, Wondaferahu Mulgeta Demissie, and Atnafu Gebremeskel Sore (2023) analyzed the connection between external debt obligation and monetary improvement in Sub-Saharan African Countries. Their review evaluated the present moment and long-haul effects of outside obligation on the financial development of 39 SSA nations somewhere in the range of 2011 and 2021, presuming that an expansion in outer obligation is linked to a 0.034% deterioration in real GDP in the short run and a 0.65% drop over the long term. The unfavourable impacts were more articulated than others.

Earlier studies have primarily concentrated on the impact of various channels of external debt on the economic development of a country, as well as the relationship between debt and growth. However, research has not examined the relationship between external debt and economic growth in the context of integration for the BRICS countries. Furthermore, the potential role of integration in addressing debt-related challenges still needs to be explored. This study aims to fill this research gap by investigating how economic integration can influence the relationship between external debt and economic growth in the BRICS countries and how it can help them solve debt-related problems.

3. Methodology

The Data

We have collected comparable data sets for Brazil, Russia, India, China, and South Africa from the World Bank's World Development Indicators (WDI) database from

1994-2020. We also used the data from International Debt Statistics (IDS) and individual country reports. The variables selected and used for empirical analysis are:

1. *ldsgni*: log of external debt stocks (% of GNI)
2. *ldser*: log of total debt service in US dollars to represent debt service proportion
3. *lrg*: log of real GDP growth in US Dollars in constant 1990 prices.

Nonstationary is a concern when estimating large-N and large-T panel-data models. In addition to the traditional dynamic fixed-effects models, the panel PMG model allows for the pooled mean group and its estimators.

The model

When analyzing the nexus between external debt and economic growth in the BRICS countries, Pooled Mean Group (PMG) models offer several distinct advantages compared to other panel data analysis methods. PMG models are particularly beneficial when dealing with panels where individual units have unique characteristics but share similar long-run relationships among variables. This feature is crucial for BRICS countries, which, despite their diverse economic landscapes, exhibit common long-term economic trends.

Firstly, PMG models efficiently utilize cross-sectional and time-series information, making them suitable for datasets encompassing both dimensions. This dual utility is particularly advantageous for the BRICS countries, as it allows the model to capture the dynamic relationships between variables over time while leveraging the variation across different countries. This comprehensive approach provides more precise parameter estimates than traditional models that might rely solely on cross-sectional or time-series data.

Secondly, PMG models are ideal for analyzing long-run relationships among variables while accounting for individual or group-specific effects. This is essential in the context of the BRICS nations, as it helps estimate relationships while controlling for unobserved heterogeneity. By accommodating the unique characteristics of each country, PMG models can accurately reflect the impact of external debt on economic growth, accounting for specific national contexts and policies.

Furthermore, PMG models facilitate studying dynamic relationships over time, capturing short-term and long-term effects. This capability is crucial for understanding how external debt influences economic growth in the immediate and extended future. Given the evolving economic conditions and policy responses within the BRICS countries, capturing these dynamic effects provides valuable insights into the temporal dimensions of debt management and economic performance.

However, it is necessary to acknowledge some limitations of PMG models. One fundamental assumption is the homogeneity of long-run parameters across the panel, which may only sometimes hold in practice. Besides, PMG models require high-quality data and can be complex to implement, posing challenges for researchers. Endogeneity issues, where explanatory variables are correlated with the error term, can also affect the accuracy of PMG estimates.

Despite these limitations, the benefits of PMG models, such as their ability to combine cross-sectional and time-series information, control for individual-specific effects and capture dynamic relationships, make them a robust choice for studying the intricate relationship between external debt and economic growth in the BRICS countries. By providing precise and nuanced insights, PMG models help policymakers and researchers better understand and manage the economic implications of external debt in these influential economies.

$$\Delta lrg_{it} = \varphi * (lrg_{it-1}) + \beta * ldser_{it} + \Delta lrg_{it-1} * a_1 + \dots + lrg_{it-p} * a_p + \Delta ldser_{it} * b_1 + \dots + \Delta ldsgini_{it} * b_q + e_{it}$$

Where:

- Δlrg_{it} represents the first difference of the log of real growth for entity i at time t .
- $(-1)lrg_{it-1}$ is the lagged value of the log of real growth for entity i at time $-1t-1$.
- $ldser_{it}$ represents the log of debt service ratio for entity i at time t .
- $\Delta ldser_{it}$ denotes the first difference of the log of debt service ratio for entity i at time t .
- $ldsgini_{it}$ signifies the log of debt stock to GNI ratio for entity i at time t .
- $\Delta ldsgini_{it}$ characterizes the first difference of the log of debt stock to GNI ratio for entity i at time t .
- φ is the coefficient capturing the impact of the lagged log of real growth and the current log of debt service ratio on the change in the log of real growth.
- β represents the coefficient associated with the current log of debt service ratio.
- $a_1, \dots, a_1, \dots, a_p$ are the lagged values of the log of real growth.
- $b_1, \dots, b_1, \dots, b_q$ are the coefficients associated with the first differences of the log of debt service ratio and the log of debt stock to GNI ratio.
- e_{it} denotes the error term for entity i at time t , capturing unobserved factors affecting the change in the log of real growth.

Panel Mean Group (PMG) estimation is used to investigate panel data information comprising perceptions of various entities over different periods. It aims to combine pooled OLS and fixed effects estimation advantages while overcoming their limitations. PMG estimation is instrumental when dealing with heterogeneous panels, where entities may have diverse characteristics. The method was introduced by Pesaran, Shin, and Smith in 1999. PMG estimation assumes that each entity has its short-run dynamics but shares a common long-run relationship across the panel. It considers individual and time-explicit fixed impacts and a common slope coefficient for the independent variables. The model's key assumption is that the long-run coefficients of the response factors are homogeneous across all entities. PMG estimation involves first estimating individual entity-specific models using OLS. Then, the mean of the estimated coefficients across all entities is computed. Next, the mean coefficient values are used to estimate the long-run relationship. PMG estimation also calculates entity-specific short-run coefficients, allowing for variations in dynamics across entities. The method provides

efficiency gains by accounting for heterogeneity over traditional pooled OLS estimation. It also allows for better control of individual entity characteristics through fixed effects. PMG estimation is robust to certain types of heteroskedasticity and autocorrelation. However, it assumes that the long-run coefficients are constant across entities, which may only sometimes hold in practice. PMG estimation requires a sufficiently large number of periods to estimate short, accurate- and long-run relationships.

4. Data Analysis and Findings

Researchers often conduct diagnostic tests to ensure the validity of the PMG results, such as testing for residual autocorrelation and heteroskedasticity. PMG estimation offers a flexible and powerful approach to analyzing panel data by capturing individual entity dynamics and common long-run relationships. Before estimating the model, we checked the panel's cross-sectional dependence in the study. The results are presented in Table 1.

Table 1. Cross-Sectional Dependence Test

Test	Statistic	Probability	Decision
Pesaran	3.246	0.0012	CS dependence
Friedman	38.042	0.0000	CS dependence

Both the Pesaran and Friedman tests indicate the existence of cross-sectional dependence in the panel data of the BRICS countries. These findings suggest that the variables under consideration are not independent across cross-sections, emphasizing the need to account for such dependence in further analysis and modeling.

The descriptive statistics (table 2) provide insights into the central tendency, variability, and distributional characteristics of the variables "lrg," "ldser," and "ldsgni." The evidence suggests the data are normal except for the variable lrg.

Table 2. Descriptive Statistics

Variable	Obs	Mean	Std. dev.	Min	Max	JB Normality
lrg	117	-3.231979	.8525812	-6.248138	-2.017023	No
ldser	135	23.15646	.8318335	20.89282	24.85009	Yes
ldsgni	135	3.141988	.4393773	2.123332	4.560908	Yes

To study further, we looked into the second generational unit root test of Pesaran for the variables included in the model:

Table 3. Pesaran's CADF Test

lrg	d.lrg	ldser	d.ldser	ldsgni	d.ldsgni
Z[t-bar]	Z[t-bar]	Z[t-bar]	Z[t-bar]	Z[t-bar]	Z[t-bar]
-4.512	-1.396	0.350	-6.020	1.323	-4.053
(0.000)	(0.081)	(0.637)	(0.000)	(0.907)	(0.000)

The Pesaran CADF (Cross-Sectionally Augmented Dickey-Fuller) test is a method used to examine whether the variables are stationary, particularly when cross-sectional dependence is observed in the data. The "Z[t-bar]" are the test statistics, which show how many standard deviations the observed test statistic is from the mean under the null hypothesis of non-stationarity. The values in parentheses represent the p-values associated with each test statistic. For the first variable ("lrg"), the test statistic is -4.512 with a p-value of approximately 0.000, indicating strong evidence against non-stationarity. For the differenced series of the first variable ("d.lrg"), the test statistic is -1.396 with a p-value of approximately 0.081, suggesting weaker evidence against non-stationarity (but still significant at conventional levels). Similarly, the test statistics are statistically significant for the other variables, their differenced series. With these results, we have decided to use the PMG model based on the panel ARDL model.

In addition to the above tests, the study conducted endogeneity tests using the Durbin-Wu-Hausman, and Wooldridge tests for autocorrelation. The results are presented in the following tables:

Table 4. Endogeneity Tests

H0: Variables are exogenous		
Durbin (score) $\chi^2(1) =$	0.325106	(p = 0.5686)
Wu-Hausman $F(1,104) =$	0.314010	(p = 0.5764)

Table 5. Wooldridge test for Autocorrelation

H0: No first-order autocorrelation	
F(1, 4)	1.525
Prob > F	0.2845

For both the Durbin (score) test and the Wu-Hausman test, the null hypothesis is that the factors in the model are exogenous, meaning they do not correspond with the error term. The p-values for the two tests are moderately high (0.5686 and 0.5764, separately), demonstrating inadequate proof to dismiss the null hypothesis. In this way, in light of these tests, there is no sign of endogeneity among the factors in the model.

The Wooldridge test for autocorrelation evaluates whether first-order autocorrelation exists in the model’s residuals. The hypothesis is that there is no first-order autocorrelation in the data. With a p-worth of 0.2845, the evidence is for no first-order autocorrelation. In light of these endogeneity and autocorrelation test results, there is no proof to propose that the factors in the model are endogenous or that there is first-order autocorrelation.

Model Estimation

We attempted Pooled mean group (PMG) estimation, a method commonly employed in panel data analysis to address heterogeneity among cross-sectional units while allowing for parameter heterogeneity across individuals. Mean Group (MG) models are helpful when there is heterogeneity across cross-sectional units, but the relationship between variables remains the same for each unit. PMG models are dynamic panel data models that allow for cross-sectional unit heterogeneity over time. These models estimate individual-specific parameters and allow for variation across units and time. They incorporate both cross-sectional and time-series dimensions, making them suitable for analyzing panel data with both individual-specific effects and time-varying effects.

This approach combines the advantages of pooled ordinary least squares (OLS) and mean group (MG) estimation by estimating individual-specific coefficients alongside a common mean coefficient across all units. PMG estimation accommodates both cross-sectional and time-series variations in the data, making it particularly useful for panel datasets with diverse characteristics across individual entities. By capturing both individual-specific effects and common trends, PMG estimation provides more efficient and robust estimates of the underlying relationships within the panel data, thus enhancing the accuracy of the statistical analysis and facilitating more reliable inference and policy recommendations. We have estimated the PMG model using *lrg* as the dependent variable and *ldser*, *ldsgni* as the independent variables. The results are presented in the following tables:

Table 6. Yatchew Linearity Test

T H0: E[YD] linear in	D - Heteroskedasticity-robust Test			
σ^2_{lin}	σ^2_{diff}	T_hr	p-value	N
.5554726	.5844248	-.6630576	.7463532	117

Source: Computed (using de Chaisemartin & D’Haultfoeuille, 2024)

The table presents the results of a linearity test conducted by Yatchew in 1997, using a robust version of the de Chaisemartin and D’Haultfoeuille method. This test aims to assess whether the expected value of a variable Y, denoted as E[YD], is linear in another variable D. The test also accounts for the possibility of heteroskedasticity when the

variability of Y changes as the values of D change. The estimate of the variance assuming linearity (σ^2_{lin}) is 0.5554726. The estimate of the variance allowing for nonlinearity (σ^2_{diff}) is 0.5844248. The test statistic (T_hr) is -0.6630576. The p-value associated with the test is 0.7463532. Since the p-value is relatively high (0.7463532), there is not enough evidence to reject the null hypothesis that the expected value of YD is linear in D. This means that based on the data and the test conducted, there is no strong indication that the relationship between Y and D is nonlinear. The following tables present the results of the Pooled Mean Regression:

Table 7. Pooled Mean Group Regression

D.lrg	Coefficient.	Std. err	z	P > z	[95% conf. interval]	[95% conf. interval]
Ec						
Idser	-.0585933	.1525747	-0.38	0.701	-.3576341	.2404476
ldsgni	-.5500743	.242895	-2.26	0.024	-1.02614	-.0740088
Brazil						
Ec	0.000	-1.280458	.2091333	-6.12	-1.690352	-.8705646
Idser D1	.1169438	.4246601	0.28	0.783	-.7153746	.9492622
ldsgni D1	-3.190794	.7588068	-4.21	0.000	-4.678028	-.170356
_cons	-.8112633	4.46531	-0.18	0.856	-9.563111	7.940584
Russia						
Ec	-.5528887	.1130169	-4.89	0.000	-.7743978	-.3313795
Idser D1	-.2367738	.2206043	-1.07	0.283	-.6691503	.1956027
ldsgni D1	-2.466925	.744074	-3.32	0.001	-3.925283	-1.008566
_cons	.0790138	1.946162	0.04	0.968	-3.735394	3.893422
India						
Ec	.2614058	.2212438	1.18	0.237	-.1722241	.6950357
Idser D1	-.1231062	.0915559	-1.34	0.179	-.3025524	.05634
ldsgni D1	-1.257103	.4678948	-2.69	0.007	-2.17416	-.3400461
_cons	-.2087136	.9212716	-0.23	0.821	-2.014373	1.596946

Table 7. Continued

D.lrg	Coefficient.	Std. err	z	P > z	[95% conf. interval]	[95% conf. interval]
China						
Ec	-.9014902	.2228795	-4.04	0.000	-1.338326	-.4646543
Idser D1	.1829745	.2374509	0.77	0.441	-.2824207	.6483697
ldsgni D1	.0625106	.5006614	0.12	0.901	-.9187677	1.043789
_cons	-.0343425	3.112337	-0.01	0.991	-6.134411	6.065726
South Africa						
Ec	-.5513958	.2359748	-2.34	0.019	-1.013898	-.0888936
Idser D1	.2442757	.250947	0.97	0.330	-.2475714	.7361228
ldsgni D1	.8266227	1.040129	0.79	0.427	-1.211992	2.865237
_cons	-.4949714	1.801152	-0.27	0.783	-4.025164	3.035221

We tried an interrupted time series analysis for South Africa, treating 2010 as an integration year: it was the year when the country joined the BRIC group. The results are the same after the integration; the negative relationship is more pronounced, and the difference is also marginally statistically significant. The following table reveals this:

Table 8. ITSA for South Africa(2010)

Treated : $_b[_t] + _b[_z_t] + _b[_x_t2010] + _b[_z_x_t2010]$						
Controls : $_b[_t] + _b[_x_t2010]$						
Difference : $_b[_z_t] + _b[_z_x_t2010]$						
Linear Trend	Coef.	Std. Err.	t	P > t	[95% Conf. Interval]	
Treated	-.1362793	.0543098	-2.51	0.014	-.243942	-.0286165
Controls	-.0236838	.0327033	-0.72	0.471	-.0885142	.0411466
Difference	-.1125954	.0590808	-1.91	0.059	-.2297162	.0045253

We have estimated PMG and DFE models and checked for model selection using the Hausman test. The test result indicates the choice of the PMG model. The null hypothesis was that b is consistent under Ho and ha obtained from the PMG model.

The $\chi^2(2) = (b - B)'[(V_b - V_B)^{-1}](b - B)$ value achieved is 0.31 and the $\text{Prob} > \chi^2 = 0.8564$.

After estimating the model, we did some diagnostic tests to check its reliability. Homoscedsticity assumption is tested using The Breusch-Pagan/Cook-Weisberg test. The test evaluates whether the variance of the error term in the regression model is constant across all levels of the independent variables. The p-value of 0.0013 indicates strong evidence against the null hypothesis of constant variance. Therefore, we reject the null hypothesis and conclude that significant heteroscedasticity exists in the regression model. The results are presented in the following table.

Table 9. Breusch–Pagan/Cook–Weisberg Test

H0: Constant variance	
$\chi^2(1)$	= 10.35
$\text{Prob} > \chi^2$	= 0.0013

The omitted variable test, the Ramsey RESET test, evaluates whether the regression model adequately captures the relationship between the dependent variable and the independent variables. Specifically, it assesses whether there are omitted variables, meaning important factors left out of the model, which could bias the estimation results. The test's null hypothesis (H0) is that the model has no omitted variables, indicating that the specified regression equation adequately represents the relationship in the data. The alternative hypothesis suggests the presence of omitted variables. The p-value of 0.4894 is relatively high, indicating insufficient evidence to reject the null hypothesis. This suggests the specified model adequately captures the relationship between the dependent and independent variables based on the Ramsey RESET test. The results are presented in the following table.

Table 10. Ramsey RESET test

H0: Model has no omitted variables	
$F(3, 109)$	= 0.81
$\text{Prob} > F$	= 0.4894

The Variance Inflation Factor (VIF) test is used to assess multicollinearity among the independent variables in the model. For both "ldser" and "ldsgni" variables, the VIF values are reported as 1.01, and their corresponding $1/\text{VIF}$ values are approximately 0.987. These values are close to 1, indicating almost no multicollinearity between these variables. The "Mean VIF" is also reported as 1.01, further confirming the absence of multicollinearity on average across all independent variables in the model. The resits are as follows:

Table 11. VIF test

Variable	VIF	1/VIF
ldser	1.01	0.987203
ldsgni	1.01	0.987203
Mean VIF	1.01	

Overall Outcomes (The Group)

Based on these PMG model results, we can conclude that the coefficient for “ldsgni” is negative and statistically significant at the 5% level, as its p-value is below 0.05. However, the coefficient for “D.lrg” is insignificant, as its p-value is above 0.05, showing no relationship between changes in the debt service proportion and changes in the log of real GDP growth for all BRICS nations.

Results for Individual BRICS Nations

Brazil: We can see that the coefficient for “ldsgni” is statistically significant at the 5% level, as its p-value is below 0.05. The other coefficients are not statistically significant. The coefficient for ldsgni is statistically significant and negative, demonstrating that an expansion in the debt obligation stock to GNI proportion is related to a lessening in actual growth for Brazil. Brazil (with a 27.9% external debt burden) should access the BRICS Development Bank to finance its infrastructure projects, reduce reliance on expensive external borrowing, and solve its external debt problems. Brazil’s expertise in managing debt crises can provide valuable insights to other member countries. Joint initiatives for economic cooperation can open up new trade opportunities, boosting revenue generation.

Russia: The coefficient of ldser is not statistically significant, showing no relationship between changes in the debt service ratio and changes in the log of real growth for Russia. Notwithstanding, the coefficient of ldsgni is significant and negative, proposing that an expansion in the debt stock to GNI proportion is related to sluggish growth for Russia. With a 15.7% external debt burden, the country should share experiences managing debt during economic downturns and leveraging fiscal policies effectively to help Russia. Access to energy resources can reduce dependency on expensive imports, thereby conserving foreign exchange reserves. Collaboration on technology and innovation can spur economic growth, creating avenues for debt repayment.

India: The coefficient of ldser is insignificant, suggesting no significant connection between changes in the debt service ratio and changes in India’s log of real growth. The coefficient of ldsgni is significant, demonstrating a negative connection between changes in the debt-stock ratio and changes in real growth for India at the 10% significance level. India (with an external debt burden of 18.4% should leverage the BRICS platforms to renegotiate debt terms with creditors, potentially lowering interest rates and extending

repayment periods. Knowledge sharing on effective debt management strategies, including fiscal discipline and monetary policies, is needed. Strengthening bilateral trade ties within BRICS countries can enhance export revenues and ease India's debt burdens.

China: The coefficient for $ldser$ is insignificant, suggesting no connection between changes in the debt obligation proportion and changes in the log of the real growth for China. Furthermore, the coefficient for $ldsgni$ is also insignificant, demonstrating no significant relationship between changes in the obligation stock to GNI proportion and changes in genuine development for China. The country with a 13.4% debt burden should provide financial assistance and favourable loan terms to its fellow BRICS members, facilitating debt restructuring. Sharing expertise in infrastructure development can stimulate economic growth and increase revenue streams for debt repayment. Promoting trade in local currencies among the BRICS nations can reduce reliance on foreign currencies and mitigate exchange rate risks. China provides financial assistance and favourable loan terms to the fellow BRICS members, facilitating debt restructuring. Sharing expertise in infrastructure development can stimulate economic growth and increase revenue streams for debt repayment. Promoting trade in local currencies among the BRICS nations can reduce reliance on foreign currencies and mitigate exchange rate risks. BRICS money as an alternative currency is also widely discussed these days.

South Africa: The coefficient for $ldser$ is insignificant, demonstrating no significant relationship between changes in the debt obligation proportion and changes in the log of real development for South Africa. Also, the coefficient for $ldsgni$ is insignificant, recommending no significant connection between changes in the debt stock to GNI proportion and changes in actual growth for South Africa (with an external debt burden of 40.6%). Access to the BRICS Contingent Reserve Arrangement (CRA) for emergency financing and a safety net during debt crises will help the country collaborate on capacity-building initiatives, enhance debt management capabilities, and improve financial governance. Strengthening regional Integration within Africa through BRICS partnerships can stimulate economic growth and reduce reliance on external borrowing.

5. Conclusion and Policy Implications

The study reveals a negative relationship between external debt stocks and economic growth for the BRICS countries, in line with other studies (Wang et al., 2021; Kibona & Kima, 2024). In individual countries, the importance and extent of this relationship tends to differ. Brazil and Russia demonstrate a significant negative relationship between debt stock to GNI proportion and economic growth. India shows an insignificant negative relationship between the obligation stock to GNI proportion and economic growth, proposing a comparative example with less measurable importance. In China and South Africa no significant connections between debt obligation and economic growth are observed, indicating that different variables might influence monetary performance

in varying degrees. Below, we present the policy implications based partly on empirical evidence and the country's experiences-related documentary evidence:

Policy Implications

Policymakers in the BRICS countries, especially Brazil and Russia, should prioritize strategies to manage and reduce their debt levels relative to their economic output to promote sustainable economic growth. India should also be vigilant about its debt levels, albeit the connection between debt obligation and economic growth. China and South Africa may need to focus on other factors besides debt management to drive economic growth, as debt-related variables do not significantly impact their real growth. These results provide valuable insights for policymakers in the BRICS countries to formulate effective strategies for managing external debt and fostering economic growth.

Policy Implications for Newly Joined Emerging Nations

Ethiopia: With an external debt burden of 18.4%, Ethiopia is a fragile, debt-distressed country suffering mostly from internal factors. External debt in Ethiopia has been a significant factor affecting economic growth. Studies have shown that high levels of external debt hurt economic growth (Mengistu et al., 2023). Debt service payments and the debt-to-export earnings ratio also hinder economic progress. The recent developments in Ethiopia, such as the northern conflict and the Nile River issue, budget deficits, internal conflict, infrastructure development, and ethnic problems, have created severe stress on debt management. Added to this, COVID-19 also had a severe impact on debt distress. It is recommended that the Government focuses on prudent borrowing practices and structural transformation to mitigate the adverse effects. It should also plan for debt restructuring and relief initiatives.

Egypt: Similar to Brazil and Russia, Egypt (with an external debt burden of 42.4%) should be cautious about accumulating external debt and servicing. Given its rate of economic development, high debt levels and its servicing could significantly hinder its economic growth. Leveraging BRICS platforms to renegotiate debt terms, reduce interest rates, and extend repayment periods can help the country. Political negotiations should help reduce the tension in sharing Nile River waters between Ethiopia and Egypt. The access to the BRICS Contingent Reserve Arrangement (CRA) for emergency financing provides a safety net during economic crises or external shocks. Joint investment projects within BRICS can stimulate economic growth and create employment opportunities, reducing dependency on foreign aid and debt. Collaboration on tourism and cultural exchanges can diversify revenue sources and promote sustainable development, contributing to debt sustainability.

Iran: Iran's situation might require closer monitoring. While the general effect of debt obligation on economic development might be less severe than in Brazil and Russia, it is crucial to carefully manage its debt situation (0.3%) to mitigate potential risks to its economic progress. Access to the BRICS Development Bank to finance

critical infrastructure projects will help revitalize the economy and reduce reliance on external borrowing. Collaboration on energy projects and technology transfers can enhance Iran's energy sector efficiency, increasing export revenues and fiscal stability. Leveraging BRICS platforms for diplomatic and economic cooperation may be expected to ease international sanctions and improve access to global financial markets.

Saudi Arabia and the United Arab Emirates: The oil wealth of these countries might provide a buffer against the negative impacts of debt on growth. However, prudent debt management is still essential to ensure long-term economic stability as Saudi Arabia has 20.8%, and the UAE has an 81% external debt burden. Diversifying their economies away from a reliance on oil exports would also be a wise strategy; it can be effected through joint investment projects within BRICS, thus reducing dependence on oil revenues and mitigating debt risks.

How Does BRICS Integration Help Emerging Economies?

The integration should aim at joint advocacy for reforming global financial institutions to better address the needs of emerging economies, including fairer debt restructuring mechanisms. An attempt should be made to pool resources for joint investment projects, such as infrastructure development and industrial cooperation, to stimulate economic growth and revenue generation. Coordination is essential in macroeconomic policies to maintain stability and attract foreign investments, reducing vulnerability to debt distress, particularly in African countries. The sharing of knowledge and best practices in debt management, risk assessment, and financial regulation among the BRICS members enhances resilience to external shocks. It is crucial to facilitate technical assistance and capacity-building programs to strengthen institutional debt management and financial governance frameworks. Collaborating on research and analysis of global economic trends is essential as it enables better-informed policy decisions to mitigate debt risks and promotes diversification of export markets and products to reduce dependency on volatile commodity prices. It is equally important to enhance revenue stability for debt servicing and encourage ventures in areas with high development potential, such as technical know-how, renewable energy and healthcare, to generate alternative revenue streams. Investigating inventive financing components, like green securities and public-private associations, to subsidize sustainable advancement projects and pay off past debt commitments dependence was considered a pressing need of the hour. The member countries should strengthen intra-BRICS trade and investment ties, foster closer economic cooperation with other regional blocs to improve market access and increase revenue sources, support regional infrastructure projects, such as transportation and energy networks to augment connectivity, ease trade, and promote economic development and debt sustainability. Harmonization of regulatory frameworks and standards within BRICS and across regional integration initiatives is needed to facilitate cross-border trade and investment, reducing transaction costs and enhancing competitiveness.

Through these avenues of collaboration and shared experiences, joining the BRICS association can provide newly emerged economies with valuable resources and strategies to effectively manage their debt problems.

References

- Arnone, M., Bandiera, L., Presbitero, A. F. (2005). External Debt Sustainability: Theory and Empirical Evidence. *Catholic University of Piacenza Economics Working Paper*, 33, pp. 1–4
- Allen, Robert D. (2013). US Government Spending, the National Debt, and the Role of Accounting Educators. *Journal of Accounting Education*, 31: 215–31.
- Auerbach, A. J. (1997). The future of fundamental tax reform. *American Economic Review*, 87 (2), 143–146.
- Amassoma, D., (2011). External debt, internal debt and economic growth bound in Nigeria using a causality approach. *Curr. Res. J. Soc. Sci.* 3 (4), 320–325.
- Arjomand, M., Emami, K., & Salimi, F. (2017). Growth and Productivity; The Role of Budget Deficit in the MENA Selected Countries. *Procedia Economics and Finance*, 36 (1), 345–352.
- Agyeman George, Daniel Sakyi, Eric Fosu Oteng-Abayie (2022). External debt and economic growth in selected sub-Saharan African countries: The role of capital flight, *Research in Globalization*, Volume 5, December 2022, 100091
- Augustine Blessy, O.P.C. Muhammed Rafi (2023). Public debt - economic growth nexus in emerging and developing economies: Exploring nonlinearity. *Finance Research Letters*, Volume 52, March 2023, 103540
- Ayoub. A, TA Wani, and A. Sultan (2024), External debt crisis socio-economic fallout: Evidence from the BRICS nations, *Regional Science Policy & Practice*.
- P. Agrawal (2007). Economic growth and poverty reduction: evidence from Kazakhstan *Asian Dev. Rev.*, 24(2), p.90
- Barro, R. J., (1979). On the determination of the public debt. *Journal of Political Economy*, 87 (5), 940–971.
- Claessens, S., Detragiache, E., Kanbur, R., Wickham, P., 1996a. Analytical Aspects of the Debt Problems of Heavily Indebted Poor Countries. *World Bank Policy Research Working Paper Series*, No. 1618.
- Carney, G. M., Thomas Scharf, V. T., & Catherine Conlon. (2014). ‘Blessed Are the Young, for They Shall Inherit the National Debt’: Solidarity between Generations in the Irish Crisis. *Critical Social Policy*, 34: pp. 312–32.
- Chen Kong San & Lee Chin, 2023. “Impact of Public Debt on Economic Growth: A Quantile Regression Approach,” *South Asian Journal of Macroeconomics and Public Finance*, vol. 12(2), pages 250-278, December.
- Claessens, S., Kanbur Erica, R., Detragiache, Wickham, P., 1996b. Analytical Aspects of the Debt Problems of Highly Indebted Poor Countries. *Policy Research Working Paper*.
- Clements Benedict et al. (2003) *External Debt, Public Investment, and Growth in Low-Income Countries*, International Monetary Fund, WP/03/249

- Cohen, D., (1993). Low investment and large LDC debt in the 1980's. *American Economic Review*, 437–449.
- Davydenko, Nadiia, Mykola Mykhaylichenko, Zoia Titenko, and Liudmyla Tsiukalo (2023), *External Debt Management in the System of Financial Security of the State*. WSEAS
- Dougherty, S., de Biase, P., (2021), who absorbs the shock? An analysis of the fiscal impact of the COVID-19 crisis on different levels of Government. *Int. Econ. Econ. Policy*, 18, 517–540.
- Edi Harsono, Andi Kusumawati and Nirwana (2024). "External Debt Determinants: Do Macroeconomic and Institutional Ones Matter for Selected ASEAN Developing Countries?" *Economies*, 2024, 12(1), 7
- Fawzy, S., (2002). *Investment Policies and Unemployment in Egypt*.
- Fosu, A. K. F., (1996). The impact of external debt on economic growth in sub-Saharan Africa. *Journal of Economic Development*, 21 (1), 93–118.
- Herndon Thomas, Michael Ash, Robert Pollin (2013). Does High Public Debt Consistently Stifle Economic Growth? A Critique of Reinhart and Rogoff, Cambridge. *Journal of Economics*, 38(2):257-279
- International Monetary Fund. (2022). IMF Annual Report (2022): Crisis Upon Us. © Washington, DC: IMF.
- Isubalew Daba Ayana, Wondaferahu Mulgeta Demissie, Atnafu Gebremeskel Sore (2023). *Effect of external debt on economic growth in sub-Saharan Africa: System GMM estimation*
- Istiqomah, N., & Mafruhah, I. (2022). The Effect of Budget Deficit in Indonesia: A Comparative Study. *Economics Development Analysis Journal*, 11(1), 110–119. International Monetary Fund. (2022). IMF Annual Report 2022: Crisis Upon Us. © Washington, DC: IMF.
- Katsikas, Epameinondas, Nikiforos T. Laopodis, and Konstantinos Spanos. 2023. Dynamic Stability of Public Debt: Evidence from the Eurozone Countries. *International Journal of Financial Studies* 11: 149.
- Kibona, A., & Kirama, S. L. (2024). The Causal Relationship between External Debts and Economic Growth in East African Community. *The African Review*
- Khan N.H, Y. Ju, S. T. Hassan (2019). Investigating the determinants of human development index in Pakistan: an empirical analysis, *Environ. Sci. Pollut. Res.*, 26, pp. 19294-19304
- Mahyar. H (2016). Economic growth and life expectancy: the case of Iran. *Stud. Bus. Econ.*, 11 (1), pp. 80-87
- Marshall, S. E., (1985). Development, dependence, and gender inequality in the third world. *Int. Stud. Q.*, 29 (2), 217–240.
- Mencinger Jerne, Aleksander Aristovnik, Miroslav Verbic (2015). Revisiting the Role of Public Debt in Economic Growth: the Case of OECD Countries. *Engineering Economics*, 2015, 26(1), 61–66
- Muinelo-Gallo L, O. Roca-Sagalés (2011). Economic growth and inequality: the role of fiscal policies. *Aust.Econ.Pap.*, 50(2-3) (2011), pp.74–97.
- Noga, M., Postuła, M., Klepacki, J., (2018). The impact of the European public debt criterion on the real socio-economic development. *Transform. Bus. Econ*, 17, 38–54
- Pattillo, C., Helene, P., Luka, R., 2002. External Debt and Growth. IMF. *IMF Working Paper* 02/69. International Monetary Fund, Washington <https://www.imf.org/external/pubs/ft/wp/2002/wp0269.pdf>.

- Pesaran, M.H., Shin, Y. & Smith, R.P. (1999). Pooled Mean Group Estimation of Dynamic Heterogeneous Panels. *Journal of the American Statistical Association*, 94, 621-634.
- RBI Bulletin, (2021). Growth and Development in the BRICS Economies, https://www.rbi.org.in/scripts/BS_ViewBulletin.aspx?Id=20689
- Rawski, T.G. Rawski (1979). Economic growth and employment in China. *World Dev.*, 7(8-9), pp.767-782.
- Reinhart, Carmen M., and Kenneth S. Rogoff. 2010. Growth in a Time of Debt. *American Economic Review*, 100: 573–78.
- Soydan, A., Bedir, S., 2015. External debt and economic growth: new evidence for an old debate. *J. Bus. Econ. Financ.* 4 (3), 2146–7943.
- Stuckler, D., Reeves, A., Loopstra, R., Karanikolos, M., McKee, M., (2017). Austerity and health: the impact in the UK and Europe. *European Journal of Public Health*, 27 (suppl_4), 18–21.
- Singh, B. P., & Kumar, S. (2022). Public Debt and Economic Growth in India: The New Evidence. *Millennial Asia*, 0(0).
- Tanaka, Y. (2022). Necessity of Budget Deficit under Economic Growth In Monopolistic Competition. *Economics & Business*, 36(1), 45–56.
- Wang, Z., Bui, Q., Zhang, B., Nawarathna, K., Mombeuil, C. (2021). The nexus between renewable energy consumption and human development in BRICS countries: the moderating role of public debt. *Renew. Energy* 165 (1), 381–390
- WEF (2023), what is Global Debt and how high is it now? Financial and Monetary systems
- World Bank (2023), International Debt Report 2023. © Washington, DC: World Bank.
- Yashina, N., Ginzburg, M., Pronchatova-Rubtcova, N., 2015. Socio-economic situation of the countries and their public debt: perspective 2015. *Eur. Financ. Syst.* 2015, 696.