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RESEARCH ARTICLE

Assessing the nexus between fiscal policy, COVID-19, and economic growth

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Abstract

The COVID-19 issue deteriorated South Africa's already dire economic situation, exacerbated by years of considerable debt increase. The COVID-19 pandemic has disrupted trade to such an extent that some enterprises are barely working at a quarter of their potential. Furthermore, economic agents delay economic decisions while waiting to see how the crisis develops. According to some economists, increased government expenditure will raise GDP enough to keep the country's debt-to-GDP ratio steady and restore fiscal sustainability. We use a panel data model to estimate a fiscal reaction function, which we then apply to historical data to assess the government's prior efforts to maintain or restore budgetary sustainability. We calculate the impact fiscal balance, government expenditure, interest rate, and revenue changes that the government will have to make to restore the country's fiscal stability due to the financial impact of the COVID-19 issue.The findings show that fiscal balance and tax revinue have a significant impact on the economics growth, while government expenditure and corruption reduce the growth of the country.

Keywords Fiscal policy · COVID-19 pandemic · Economic growth · Government expenditure · Panel data model

Introduction

The increase in material use impacts environmental quality in the form of climate change, natural resource depletion, increased air and water pollution, and biodiversity reduction (Chandio et al. 2021; Hao et al. 2021; Razzaq et al. 2021). South Africa's mounting external debt, similar to that of every other newly developing nation, has become an area of interest for researchers and politicians as the country's economic growth slows (Yung et al. 2021). COVID-19's probable detrimental influence on borrowing money and the country's economic growth adds to this worry (Elavarasan et al. 2021; Irfan, et al. 2022a, b; Yang et al. 2021). While revenue shortfalls lead to international borrowing vs. government expenditures (Afonso et al. 2010; Faria-e-Castro 2021), specific thresholds beyond which a country's debt-to-GDP ratio can hinder growth to studies (Guo and Shi 2021; Song et al. 2022). As a result, this research aims to investigate the impact fiscal policy and COVID-19 on

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economic growth of south Africa over the period from 1990 to 2019.

According to statistics, South Africa's public spending activities have expanded the actual number and comparative conditions and as a %of GDP. The rise in government expenses resulting from the COVID-19 pandemic has destroyed the world market like South Africa. It has increased the country's debt profile to pay its financial responsibilities (Morsy et al. 2021). South Africa had been in a recession for two quarters before the pandemic lockdown. Furthermore, in the pandemic's effects necessitating loans, a 60.8% debt-to-GDP ratio was forecast for the government in the 2020 fiscal year, up from a February estimate of 56.2%. In June 2020, the administrative board of the International Monetary Fund (IMF) had permitted a loan for the USA of $4.2 billion (about R75 billion) as a result of its Rapid Financing Instrument (RFI) program to help alleviate the economic impact of the pandemic and social effects. The African Development Bank (AfDB) also approved a $288 million South Africa response assistance program (R5 billion). The debt-to-GDP ratio was 37.2% in 2015, 48% in 2016, 48.8% in 2017, 48.5% in 2018, and 51.4% in 2019, according to the South African Reserve Bank's (SARB) 5-year trend analysis (2019). Various sectors have raised concerns regarding the government's debt-to-GDP ratio growing as government spending increases.

Due to its limited scope and goal, the current study evaluates fiscal policies addressing expenditures Based on income levels during the COVID-19 pandemic-related financial downturn, it focuses on the link between government spending and economic growth (Huang et al. 2022; Waseem Iqbal et al. 2021a, b; Latif et al. 2021). From this perspective, the study's sole goal is to look at the changing monetary policies and the direction of public spending in these country groups' growth axes. The study's literature review portion discusses how public expenditures and fiscal policies might be implemented in cost-effectively decreasing countries during the COVID-19 pandemic-induced economic crisis. The study's primary focus is on the shift in public spending in reaction to pandemic circumstances and COVID-19 answers depending on countries' economic levels in terms of public spending.

Another worrying trend is the rise in debt servicing costs. For example, between 2018 and 2019, R180 billion was consumed on debt retuning. This amounts to roughly the whole healthcare financial plan for that amount of time. Furthermore, between 2018/2019 and 2008/2009, the exterior debt-to-GDP %ageenlarged from 26 to 62.5% (Ridzuan and Abd Rahman 2021). COVID-19's influence on debt servicing has the potential to be harmful to the country. In its amended 2020 financial plan, the National Treasury issued a warning in June 2020, stating that the government spends much more than it receives in taxes. Consequently, debt has increased at an exponential rate. If this trend is not halted and reversed, South Africans' lives will suffer long-term implications. In the medium run, if interest payments on the debt are not reduced, they will be a big part of the government's budget.

The difficulties of external liability and bribery are the latest challenges confronting South Africa's growth aspirations, evidenced by the above narrative. For that purpose, the study intends to investigate previous to the outbreak of COVID-19, an increase in foreign debt, economic growth, and bribery are all related, with a particular focal point on the anticipated negative economic repercussions of corruption. As a result, this study makes four contributions to the attainment of its objectives (Furger and Clitz 2021). First, we examine what was known before the outbreak of the COVID 19 pandemic about the debt-to-GDP concept. This is likely to act as a springboard for future research into South Africa's mounting debt for the duration of and following the pandemic. Second, we investigate the impact of bribery on the debt-GDP debate in the context of individual countries, which is atypic in the available literature. It is a critical gap that this research aims to close. Third, recent research on the impact of public debt on economic growth has been ambiguous. While some studies found a unidirectional relationship (Chinoy and Jain 2021; De Vito and Gómez 2020), others found a bidirectional relationship (Gechert et al. 2019; Germaschewski 2020; Mundle and Sahu 2021), and still, they believe that the relationship is nonlinear and are hence neutral in their conclusions (Polzin et al. 2015). Finally, according to the authors, this appears to be the first time a time sequence debt-GDP analysis has included dishonesty.

For a long time, South Africa's government debt-to-GDP ratio increased from 27% in 2008/09 to 62.5% in 2019/20. Then there was the COVID-19 crisis. Efforts have been made to contain the virus' spread and prepare the healthcare system for anyone who may become ill by March 2020. To put it another way, the lockout and closure of industries caused a tremendous supply shock. These actions caused an instant demand and supply shock to the economy. As a result, several businesses have temporarily shut down, and employees have been furloughed. The government announced an R600 billion (almost 11% of GDP) package in April 2020 to supplement the healthcare system and alleviate the problems that individuals and businesses have endured as a result of the crisis. These measures have shown to be successful (Wang and Zhang 2021). The package included a non-financial RS200 billion loan guarantee scheme for businesses with less than R300 million yearly turnovers. The South African Reserve Bank, for its part, would lend money to banks—only if firms default would the government guarantee be implemented. Governments worldwide have launched economic stimulus packages that combine financial policy, fiscal, and monetary measures. Direct funding includes paying unpaid employees' paychecks and sick

leave, supporting small and large firms, the government and central bank financing, and directly sponsoring healthcare systems are all examples of fiscal initiatives. The Unemployment Insurance Fund, which is not part of the main budget and hence not subject to tax deferrals or exemptions, provided R40 billion of the remaining R300 billion in wage protection. Because the government intended to reallocate R130 billion from the February 2020 budget to cover part of the unexpected costs, not all of it was deemed excessive. Aside from the COVID-19 problem, the government planned to borrow money from various financial entities to deal with its ballooning deficit and crises. The maximum of these loans is $4.5 billion from the International Monetary Fund (IMF), which will expire on July 27, 2020 (Francis et al. 2020).

Considering the current economic situation, the IMF recommended governments implement a four-tiered fiscal policy plan to assure creditworthiness in 2008 and early 2009. The pre-COVID-19 era was a period Just as an additional R600 billion was announced in April 2020 for the health system, individuals, and businesses affected by the epidemic, an additional R600 billion was announced in April 2020 for the health system, persons, and businesses affected by the epidemic. The country was on the edge of defaulting on its debt obligations. However, policymakers and academic experts are concerned about the local economy's record of a negative 0.4% by the end of 2019 compared to 2.6% 10 years ago (Morsy et al. 2021).

External borrowing is also harmful to an economy only when it has the potential to generate higher economic advantages than the interest expenses, even if it occurs within a life cycle and is not used effectively and carefully (U. Khalid et al. 2021). In general, external borrowing can increase capacity while increasing productivity, making the debt creative and feasible (Yin et al. 2021). On the other hand, the debt might lead to financial instability and increased foreign borrowing, exposing the country to various economic challenges. Debt has hampered the effectiveness of fiscal measures, and monetary authorities' authority to raise interest rates for monetary considerations was constrained, as it affects budget deficits and debt levels (Burger and Calitz 2021).

Despite growing concerns about debt sustainability in rising and up-and-coming economies, country-based study on the negative repercussions of dishonesty in the debt-to-GDP discussion are still sparse. The ongoing ignoring of corruption in the developmental literature, as Seccareccia and Rochon (2020) correctly observes, is an issue since it is a tumor to prosperity generation and economic growth. South Africa's bribery has reached such alarming levels that the country's ranking has dropped from 55th place in 2011 to 60th place in 2018. Research (Ko 2020) claimed that South Africa squandered R385 million on poverty reduction and corruption-related vices, and democratic elections in 1994 and 2016 were tainted by corruption (Y. Chen et al. 2021). The pre-COVID 19 era was when the country was on the verge of defaulting on its debt obligations, just as an additional R500 billion was announced in April 2020 for the health system, individuals, and businesses affected by the epidemic. However, policymakers and academic experts are concerned about the local economy's record of a negative 0.3% by the end of 2019 compared to 2.5% 10 years ago (Luke 2020).

The study is organized as follows: part one has an introduction, "Literature review" contains recent empirical evidence, "Methodology and data" includes data issues and methodology, "Results and discussion" contains estimated results, and "Conclusion and policy recommendation" contains a policy and conclusion recommendations.

Literature review

The slow growth model, which allows us to consider the elements that influence economic growth, serves as the theoretical foundation for this study (GDP) (Chau 2021, Tang et al. 2021; Jin et al. 2022). The dependent variable in this model is gross domestic product (GDP), which is represented as a function of labor (L) and capital (K). In its simplest form, the model of Solow growth is represented as $Y=f(K, AL)$, where Y represents GDP and K represents capital (A fixed capital structure is one of the parts of the capital substitute). Ji et al. (2021) stand for effective labor, as African countries' labor was effective due to deal liberalization and technological knowledge (Chau et al. (2021); Li et al. 2022; Rao et al. 2022; Tang et al. 2022). Furthermore, the debt overhang concept claims that if a country's debt exceeds its capacity to service it. The quantity of debt service required varies depending on its production level (Cantore and Freund 2021). The idea is that when foreign debts rise, domestic investor income is taxed away, causing local and external investments to be distorted, lowering GDP. In other words, reliance on economic aid such as money owing for economic revitalization is akin to growth stalling and appreciation (Ashihara and Kameda 2018). One strategy to stimulate economic growth, according to Keynesian theorists, is to inject additional funds into the economy (Zhuang et al. 2021). If expected revenues fall short of government spending, borrowing can accomplish this. Three key links between economic growth and debt have been found, consistent with existing economic theories (Chen et al. 2020) (Zheng et al. 2021)(Gao et al. 2020). The link could be explained by the positive Keynesian hypothesis, the negative extension of liability theory, or the neutral Ricardian correspondence hypothesis (neutral). Most hypotheses about the growth-debt link in developing countries, such as South Africa, are pessimistic (Chau et al. 2021a, b; Lau et al. 2021;

Liu et al. 2021; Yu et al. 2022). In addition, inflation was included to avoid the problem of biased omitted variables because inflation is expected to be negative in a developing economy like South Africa. Truger (2020) added corruption as an exogenous component with a declining trend in productivity to the GDP-debt hypothesis.

According to empirical reviews, the impact of peripheral debt on economic growth and the connection linking corruption and economic growth are hotly debated topics. As a result, there appears to be no consensus on these linkages, which is the best motivation for this research. For the issue of growth in debt, studies have confirmed the Keynesian notion that for economic progress, it is necessary to have a certain amount of debt, while others say that money owing in any form is harmful to any country's development ambitions (Bhowmik et al. 2022; Dupor and Guerrero 2017; Faria-E-Castro 2018). In addition, studies like Baker et al. (2016) and Olakojo et al. (2021) found conflicting results regarding the growth-corruption theory. A summary of essential literature on the growth-debt-corruption argument is provided below. As a result, this research relies mainly on Olakojo et al.'s (2021) study to analyze fiscal policy's impact on the economic system activity development in institutional variations and external debt difficulties in emerging nations. Current studies and evaluations of the repercussions and ramifications of the COVID-19 pandemic's economic crisis on countries are still far from clarifying the actual scenario (Gao et al. 2021; Zhang et al. 2020). Because this problem impacts the entire planet simultaneously, it will not be resolved soon or quickly. As a result, the suggested financial policies and suggestions for public spending under the fiscal policies, which form the study's basic framework, are still up for argument.

Public debt and economic growth

Lin & Zhu (2019a) used two alternative techniques in their research on the relationship between economic growth and India's governmental debt, which they discovered. The nonlinear 2SLS technique found that public debt is beneficial. It positively influences economic growth in the short term, but has a detrimental impact in the long term. Similarly, Chakraborty and Roy (2021) found a depressing relationship connecting Malaysia's governmental GDP and dept. It was also discovered that government consumption, and for time-series data between 1991 and 2013, supplementary monetary constraints, government spending, and the budget deficit were used as defining factors. The budget deficit decreases the functions of economic growth. Wen and Zhang (2022) employed the Markov-switching model to explain Turkey's high debt levels concerning growth, implying that the country's debt-growth relationship is nonlinear.

Gupta and Barman (2009), Jinjarak et al. (2021), and Ciaschini et al. (2013) conducted additional research on Asia, a continent with a lot of growing economies like South Africa (2018). Kharusi and Ada found the absence of a significant positive association between GDP and the country's national debt for Oman (2018). Not only that, but the ARDL's findings, based on data from 1990 to 2015, revealed that investment (a proxy for gross fixed capital creation) had a positive, if not significant, impact on economic growth. In a study on Sri Lanka by Azad et al. (2021), external debt was found to provide a boost for economic growth while debt servicing was found to have a negative relationship with economic growth. Using the PVAR technique of evaluation (Kozup and Hogarth 2008) for 48 developed and emerging economies, the debt growth theory was split into two categories: public and private. The findings indicated that public debt has various degrees of negative impact on economic growth in industrialized and emerging economies. This research recommended strategies that are likely to lower debt burdens for rising countries in order to achieve hoped-for faster economic growth.

Separate research on EU nations (Riza and Wiriyanata 2021; Zhou et al. 2018) indicated different amounts of debt-to-GDP turning points. For example, in a panel estimation of a generalized growth model (Lin & Zhu 2019b), EU member countries were separated into old and new members, confirming the existence of a nonlinear statistically significant impact of public debt on economic growth in the 25 sovereign member countries under consideration. The analysis came up with a debt-to-GDP turning point of 80–94% for prior union members and 53–54% for potential union members. Beyond these limits, any more debt achievement will be detrimental to these governments. In a similar vein, Dincă and Dincă (2015) used a quadratic equation to investigate the relationship between government debt and GDP in ten of the EU's newest members and discovered a nonlinear debt-to-GDP relationship with a turning level of roughly 50%. Yuan et al. (2022) found a significant amount of external debt in Ukraine and certain other emerging economies in Europe, notwithstanding volatility in the macroeconomic environment impeded development prospects.

Some research on the debt-GDP debate in the OECD group has mixed results resulting from the interpolation of emerging and developed economies (Bordo and Levy 2021). Dzigbede and Pathak (2020) examined and determined the turning point of debt to GDP in 31 OECD and five non-OECD countries, confirming the hypothetical supposition that a low debt to GDP is better than a greater one. From 1980 to 2010, a panel estimation using a generalized economic growth model was used. The study classified the nations into established and emerging economies and recommended a 90–94%turnaround point for urbanized economies, and emerging economies account for 44–45% of the

total. In another study, Dulal et al. (2015) looked at 7 OECD developed economies and found that in those countries, there is no evidence of nonlinearity in the relationship between public debt and economic growth. The optimal debt-to-GDP ratio relies on measurement, time, and each country's unique qualities in terms of developmental stages and techniques. The evaluated condition was not submitted to forcefulness testing in these investigations, which had ramifications for the studies.

The Reinhart-Rogoff (RR) hypothesis on the link between economic growth and debt has also been criticized, with researchers claiming that there is no rule of thumb in the two scholars' 90% prescription (Dulal et al. 2015). Loayza and Pennings (2020a, b) investigated this concept in twenty highly developed economies and found errors in the summary's data, coding scheme, and statistical weighing (Hepburn et al. 2020). It has been demonstrated that mutual agreement on this relationship is not static but can also be negative, positive, or even nonlinear in their assessment of SCOPUS listed works. In a study using the ARDL technique on EU countries (Truby et al. 2022) that at the 70% level, the connection is nonlinear. According to the findings of these studies, the relationship is a function of time and each country's developmental level.

The minimal amount of literature that has been reviewed on the linkages between government debt and economic growth in Africa generated inconsistent results. This is due to the fact that each country's peculiarities and variables measurement varies. For example, Muhafidin (2021) and Pogorletskiy and Pokrovskaia (2021) found an excellent bidirectional Ghana link between national debt and GDP but a weak relationship in Nigeria, as illustrated by Pogorletskiy and Pokrovskaia (2021). Kozup and Hogarth (2008) discovered a statistically insignificant negative link for Malawi, whereas Zuo and Zhong (2021) found miscellaneous long-run impacts and a statistical significant negative impact in the short term for Uganda. Of debt servicing, public debt, and GDP for Zambia, using a dynamic multivariate ARDL bounds test researchers discovered a unidirectional causality relationship between public debt and economic development. The study, which covered the years 1970 to 2017, found no indication of a link between debt servicing and GDP. In conclusion, the afflicted countries should exercise caution while using externally sourced debt and prevent frivolities.

As a result of the present COVID-19 pandemic, many countries have little choice but to rely on fiscal borrowing to solve their economic woes. This has generated concerns about South Africa's growing state debt, which is already approaching alarming leverage levels. e Castro (2020) with varying degrees of control variables, threshold levels, and estimate methods, they have all contributed to a better understanding of the debt-GDP nexus in South Africa and policy recommendations. After researching the dynamic in South Africa, there is a link between accumulated external borrowings and GDP, and Gonz and García-alb (2021) proposed a debt-to-GDP ratio of 31.3% for the sake of the country. The nonlinear smooth evolution deterioration model's results indicated that South Africa's GDP status would significantly establish the ideal debt-to-GDP ratio. However, according to a recent study by the National (Khan et al. 2021), in 2019, the government borrowing-to-GDP ratio increased to 59.3%from a previous high of 31.8% in 1990. Economic activity decreased to 0.7% in 2019, compared to 4.2% in 2000, according to a 2020 IMF report.

Wei and Han (2021) investigated the causes of government debts in post-apartheid South Africa using the ARDL model and exposed that public debt negatively impacts inflation and economic growth. The research looked at actual GDP, government spending, other factors, and concern rates as the fundamental causes of government indebtedness, also recommended that government debts could be reduced by improving productive capacity, controlling interest rates, and eliminating wasteful government expenses. Bui (2018) and Truby et al. (2022a) tested for the short- and long-term adverse effects by applying the same ARDL for time-series data spanning 2002–2016. Researchers discovered a negative connection between debt and GDP in South Africa. In Una et al. (2020), analysis of the relationship between South Africa's military spending and GDP indicates that the bond is nonlinear in nature. The Logistic Smooth Transition Regression model results for 1988–2014 also suggested that government expenditure on the military was excessive. That money could be better spent elsewhere in the economy. Loayza and Pennings (2020b) and Hutchison (2020), on the other hand, support a positive association between debt and economic growth. Chakraborty and Thomas (2020) found that borrowing from outside the country positively impacts GDP, they were using the external factors-led growth hypothesis for South Africa, which was in accordance with an earlier study on Nigeria.

Studies have also connected the well-known Wagner law to government spending and economic growth, which states that higher government expenditure increases economic activity (Haar 2020). In the Keynesian intangible conflicting direction, there are also in-between arguments that expenses cause an increase in government movement or economic growth (Gootjes and de Haan 2020). For example, Choi and Mai (2018) looked at the nonlinear government expenditure cum growth nexus for South Africa and discovered that a significant component of Wagner's hypothesis did not hold for the country. In particular, to some extent, the study supported the Keynesian theory by finding a unidirectional relationship between government spending and economic activity. Finally, the study concluded that the South African

government's excessive spending was not a solution to any financial or monetary issue.

According to Nong (2021), South Africa's governmental debt-to-GDP ratio doubled between 2015 and 2016, reaching an alarming proportion of 44.3%. They used the ARDL to investigate whether public debt impacts economic growth via investment, and they found a dismal association between the relationship between government debt and investment growth. While borrowing was encouraged in order to boost capital accumulation, it was also discouraging. The study recommended that it be restricted to a manageable level. On the other hand, unbundled public debt into domestic and foreign debts in order to separate the aggregated effects of public debt on economic development from the impact of specific public debt components. They came to the termination that total public debt has both long-term and short-term negative effects on economic growth.

COVID-19 and economic growth

The COVID-19 catastrophe caught everyone off guard (Iqbal et al. 2021a, b; Razzaq et al. 2022; Wen et al. 2022). There are many factors that determine how people respond to crises, including internal, external, and even personality characteristics (Ahmad et al. 2022; Irfan et al. 2022a, b; Jiuru et al. 2021). A health issue posed by COVID-19 prompted a rapid response from South Africa compared to countries such as Brazil, Mexico, and the USA (Jiang et al. 2021). Within 23 days of the initial illness, SA instituted lockdown. An 18-day advantage over Italy, and half the time, it took the USA to deploy a lockdown were the benefits of this lockdown. Nearly everyone agrees that SA has not seen such quick and decisive action in decades—the swift installation of a lockdown. SA's healthcare system, however, would not have been able to handle an exponential rise in patients compared to Italy, Germany, and the USA. In 2017, health spending in SA amounted to just US$28 billion, or 8.1% of GPD. Compared to Italy's 8.8%, it is close; nevertheless, the GDP of Italy is dwarfed by SA's at US$1.951 trillion versus US$350 billion. That is six times more than South Africa's healthcare spending, at about US$172 billion (Fornaro and Wolf 2020). As a result, while SA was able to gauge the early impact and response from other countries, the country's healthcare system was not prepared to handle an inflow of patients. This is not to say that COVID-19 did not constitute a severe threat to human health and economic growth.

The following first-quarter GDP figures offer context for the predicted severity of COVID-19's impact on SA's significant industries because the second quarter's data is unavailable. Construction (4.7%); mining (21.5%); manufacturing (8.5%); power, gas, and water (5.6%); and transportation (4.7%) all saw significant increases in GDP in the first quarter of 2020. The agricultural industry was the only one to see any significant growth (+27.8%). While the agricultural sector accounted for just 1% of GDP in 2019, the mining industry contributed 9% of GDP in 2019 (Ziolo et al. 2019). These factors point to a significant reduction in corporation tax collection in the second and third quarters.

SARS Commissioner Edward Kieswetter estimates that the gap in collections is roughly R285 billion. South Africa's 2020 budget will be further strained as a result of this gap. South Africa's reliance on manufacturing and mining has worsened the strain on the country's fiscus, both of which have had lower productivity and negative growth in this era (Garton et al. 2020; Khalid and Salman, 2020). Another future national financial crisis could occur in 2024, according to the country's finance minister. That is why government expenditure cuts are necessary. According to the Supplementary Budget Review (SBR) released on June 24, 2020, the debt-to-GDP ratio is predicted to peak at 87% in 2023/2024 if zero-based budgeting principles are implemented and the public sector salary bill is reduced (Deleidi et al. 2020).

Corruption and economic growth

There has been a lot of debate on this topic since the effort of Tchilsina and Pargal (2020), one of the earliest researchers to study the link between corruption and economic growth. According to Singhal et al. (2019), most studies on the relationship between external debt and GDP were based on panel studies, indicating that country-based research is still scarce. As part of their investigation of the impact of external debt and corruption on economic growth in Kenya, Malawi, Nigeria, South Africa, and Uganda, García and Mejía (2018) used FMOLS and DOLS methodologies. Furthermore, the study found that foreign debt and economic development had a negative relationship in addition to a bidirectional one. A one-way correlation between economic growth and corruption was also found, and a positive correlation between corruption and economic growth in these countries. This study's findings cannot accurately reflect the current state of affairs in South Africa for the easy reason that governmental debts and economic growth vary from country to country. Not only that, but a panel study like this one may highlight the negative impact of corruption at the country level.

It was found that the public debt effect on growth is linked to corruption by Howes et al. (2019), who used three techniques of estimation: the Pooled OLS, the FE models, and the Dynamic Panel GMM. Furthermore, the study found that public debt had a detrimental impact on economic growth in corrupt countries and a favorable effect on more transparent and less corrupt governments. Rentschler and Bazilian (2017) added credence to the idea that corruption is a declining function of economic growth. Malerba et al. (2021) came

to two distinct conclusions about the BRICS due to methodological variances in their studies. While the rigid result reveals a negative contact, the GMM findings showed that corruption positively influenced GDP from 1996 to 2014. While Criscuolo & Menon (2015) conducted a negative correlation between corruption and economic growth, Criscuolo and Menon (2015) identified a positive correlation.

Padhan and Prabheesh (2021) focused on the interplay between tax evasion, corruption, and a country's public debt to influence fiscal policy. A new quantitative fiscal policy theory stated that corruption might lead to a heavily borrowing government even if an economy's debt level is zero. An increase in public debt and decreased output and well-being were both predicted to occur if corruption was allowed to grow unchecked. In addition, the impact of corruption on public debt on a panel of OECD nations that spans 1995 to 2015 found that public debt is arising the purpose of corruption. It was also noted that reducing corruption by half in the short-term would cut public debt by 2%. The long-term negative effects of corruption on foreign borrowing are still evident in some nations with a high level of corruptive tendency.

According to the study by (McKibbin and Vines 2020), for five ASEAN countries, foreign government debts, corruption, and GDP relationship constituted the basis of their research, which admonished the governments in their desire for higher debts. It also found a direct link between foreign debt and economic growth, with no correlation to corruption or economic development in the analyzed countries (Akbtar et al. 2020; Asbahi et al. 2019; Nasir et al. 2022; Xiang et al. 2022). Essentially, a certain level of corruption is necessary for economic growth, particularly bureaucratic activities. According to Stavytskyy et al. (2020), results from the application of the Bootstrap Panel Granger causality technique, there is a correlation between corruption and GDP in South Korea and China.

As a result of the preceding analysis, we can draw two conclusions. Because the negative impact on economic activity cannot be ignored, researchers do not include corruption in the debt-GDP hypothesis—country-specific studies on how corruption, external debt, and economic growth interact are still rare. As a result, we are hoping to close this knowledge gap by focusing our research on South Africa.

Methodology and data

Model specification

The empirical analysis in this paper is based on a dynamic panel regression framework and a fixed effect estimating method. Because the null hypothesis is rejected at a level of 1% significance, the Hausman test favors the fixed effect model over the random effect model. Heteroskedasticity is taken into account in the econometric analysis by using a one-way error component fixed effect model and robust standard errors. Different regression equations generally use explanatory variable. Equation (1) can be rewritten to have the estimable version of the aforementioned equation.

$$EG_t = a_0 + \beta_1 \ln Fiscal\ balance_t + \beta_2 \ln Debit\ ratio_t + \beta_3 \ln Inflation_t + \beta_4 \ln Tax\ Revenue_t + \beta_5 \ln Gov't\ Expenditure_t + \beta_6 \ln Real\ interest\ rate + \alpha_i + u_t \quad (1)$$

where EG is economic growth, InFiscal balance$_t$=log of fiscal balance, InDebit ratio=the public debt ratio, InGov't expenditure=log of government expenditure on administration, InReal interest rate=log of real interest rate, Intax revenue=log of tax revenue, a_i=the unobserved effects, and u_t=the error term on the t^{th} year.

Table 1 Descriptive statistics

Variable	Mean	SD	Min	Max
Fiscal balance	−2.522	4.742	−18.073	20.482
Inflation	8.52	11.288	−11.686	98.224
Economic growth	4.225	8.048	−62.076	149.973
Corruption	43.43	0.98	42	45
Real interest rate	10.461	49.649	−93.515	1158.026
Public debt ratio	69.562	63.051	0.278	335.668
Gov't expenditure	−0.707	0.599	−2.389	1.049
Tax revenue	−0.506	0.879	−2.815	1.282

Data and variable

Table 1 presents the descriptive statistics of the study variables. The time-series data utilized in this study came from the State Bank of South Africa statistical bulletin for 2020. Fiscal balance, inflation, GDP growth, corruption, real interest rate, debt ratio, gov't expenditure, and tax revenue was collected over the period of 2010 to 2020.

Results and discussion

Correlation matrix analysis

Starting with the point review of the study's findings, including summary data, findings, and implications based on the correlation matrix. Table 2 contains vivid data that supply a universalsummary of the variables employed in the study. The retort variable, fiscal balance, has 2.5%, implying that most African countries are in debt. The temperature anomaly has a standard deviation of 0.70, meaning that the climate in Africa is warming by 0.70 °C every year on average.

Table 2 The correlation matrix

Variable	1	2	3	4	5	6	7
Fiscal balance	1						
Inflation	0.240**	1					
GDP growth	0.616***	0.0291	1				
Corruption	0.0141	0.0823	0.0324	1			
Real interest rate	0.0611	0.128	0.0173	0.964***	1		
Public debt ratio	0.442***	0.142	0.13	0.193*	0.309***	1	
Gov't expenditure	0.283***	0.193*	0.243**	0.265***	0.165*	0.080	1

***, **, *denote statistical significance at the 1 and 5% and 10% levels, respectively

Table 3 Cross-sectional dependence statistics

Test	Statistic	Prob
CD_{BP}	203.00364	0.000
CD_{LM}	8.603175	0.000
CD	8.2929483	0.000
LM_{adj}	3.4041504	0.0012

dependence, which is supported by the statistical significance of the cross-sectional dependence statistics.

This test is preferable to earlier panel unit root tests as shown in Table 4, such as the Sun et al. (2020) test, which did not make it possible for cross-sectional correlations, and has recently been used in PPP tests (Nawaz et al. 2021). It is most likely that residuals are associated across individual

Table 4 Panel unit root tests (IPS and CIPS)

Variables	IPS unit root test		CIPS unit root test	
	Level	First difference	Level	First difference
Fiscal balance	3.[illegible]38	3.72015	3.95325	5.02845
Debt ratio	2.578[illegible]	4.8069	3.8766	4.961355
Corruption	2.[illegible]21025	5.65866	2.88015	4.03326
Government expenditure	1.762[illegible]45	4.82811	1.71255	4.964715
Real interest rate	1.[illegible]67295	3.74619	3.98055	3.90705
Tax revenue	1.758015	5.71011	2.50005	3.8031
Money supply	3.438225	4.92786	4.01205	3.708705
Industrial output	2.716665	5.82036	4.017405	2.66385

, *, *denote statistical significance at the 1 and 5% and 10% levels, respectively

Weather event 1 has a 9[illegible]% chance of occurring within a year in an African country. In addition, weather events 2 and 3 have a 30% and 7[illegible]% risk of occurring, respectively. Meteorological events in East Africa are higher than in the rest of the African continent for the sample period.East Africa has an average of 80% of weather events per year, compared to 49% in Central Africa, 51% in West Africa, and 57% in Sub-Saharan Africa.

CD and unit root test

Testing for cross-sectional dependence shows that the series is dependent on itself. Four different tests were performed to determine whether or not CD was present. The results of these tests (CDBP, CDLM, CD, and LMadj) are illustrated in Table 3. The findings presented here consistently do not accept the null hypothesis of independence across sections, signifying the existence of data showing cross-sectional time-series when cross-country regressions are present, as they are in this research. We get the CIPS (Cross-sectionally Augmented IPS) statistic by taking their simple average. At a level, all variables are stationary, so the order of integration is $I(0)$, and we can rule out the possibility of a unit root. Furthermore, certain factors are significant at a 1% level of significance, while the others are significant at a 5% or 10% level of significance. At a 1% significance level, foreign direct investment, GDP growth rate, and inflation rate are significant. At a 5% level of significance, the other variables, such as CO_2, EG, SG, and PG, are significant. Because variables are stationary at the level, these results show that ordinary least square (OLS) is an accurate estimation approach.

Main estimation results

Pooled OLS and fixed effect estimates are shown in Table 5 of this section. According to *p*-values obtained from

Table 5 Main estimation results

	PooledOLS	Fixedeffect
Fiscal balance	5.54 ** (2.124)	5.32*** (1.33)
Tax revinue	7.34*** (2.352)	7.33*** (3.761)
Corruption	−4.655*** (2.362)	−3.552*** (2.442)
Government expenditure	−0.0572** (−0.125)	−0.0631*** (−0.223)
Real interest rate	−0.6252*** (−0.245)	−0.0551*** (−0.227)
Debt ratio	0.387*** (−1.075)	0.417*** (1.271)
Constant	−0.477*** (−0.011)	−2.642*** −0.342)
R-squared	0.9213	
AR (1)		0.0001
AR (2)		0.3058
Sargan test		0.6863

***, **, * denotes significance level at 1%, 5% and 10%. Parenthesis denotes *t* statics

Arellano-Bond and Sargan tests, the fixed effect method is both valid and effective. In all of our models,the fiscal balance has a considerable impact on the economic growth of South Africa. As a result, a 1% increase in the fiscal balance improves economic growth by 5.32%, implying that Africa's budget deficit decreases during pendamic. This is because all other factors are equal, pendamic are followed by higher tax receipts, giving South African governments more fiscal room. This supports Can and Canöz (2021) findings for emerging nations, EU nations, and OECD nations. It also corresponds to van der Wielen and Barrios (2021).

Moreover, the debt ratio from the previous year has a favorable and considerable impact on economic growth. This means that the government's debt from the previous year signals a limited fiscal space and the need to be prudent about future spending. This conclusion is in accord with others (van der Wielen and Barrios 2021). They argue that nations with high debt-to-income ratios should pursue debt association activities to decrease their debt load and improve their fiscal balance for economic growth. Our sample with a high level of debt influence of war and real interest rate lag on fiscal balance. The coefficient of government expenditure on economic growth is −0.631. The *P*-value is 0.0000, which is significant. The correlation between the two is considerable, and negative gross domestic product (GDP) and government spending on administration gross domestic product (GDP) and government spending on management, contrary to our expectations. According to the findings, an increase of 1% in government spending on management will have the following effects: a 6.31% decrease in economic growth; this deviation from our expectations could be due to spending on consumables being a major revenue source for these industries. In some cases, for politicians who hold public office in South Africa, this industry has been a hotbed for theft and embezzlement in the past.

The result suggests a positive and significant link between money generated by government taxes and the country's GDP, with a coefficient of 7.33. A 1% increase in tax revenue boosts economic growth by 7.33% when all other variables are constant. This is consistent with our presumption, as government income tax through investment will improve the nation's output. The corruption has a coefficient of −3.552, with an insignificant *P*-value of 0.1283, which indicates a negative link between the corruption and South Africa'seconomic growth for the time period of study. Increasing the corruption by 1% will result in a 3.552% decline in the economic growth. This is contrary to our expectations by the is says that government expenditure is a function of the government, particularly the budget deficit can aid in the prevention of a downturn or depression in the short term. This might lead to the closure of multiple companies, the closure of the bulk of banks, a decrease in demand for industrial and commercial assets, a shift in supply chains, and a significant reduction in GDP this year as a result of this massive impact. Many countries' GDP estimates for 2020 are off by a significant margin. Due to a lack of efficiency and excessive expenditure on COVID-19 victims and their families, many of the world's most strong countries are now facing high inflation and rising unemployment.

COVID-19 shock

The analysis uses a sample of South Africa as a baseline in order to determine the link between the COVID-19 event. It calculates the Bayesian PVAR framework and computes orthogonal auto-correlation functions (IRFs) and regression decomposition to track the influence of COVID-19 on industrial activity (FEVD). When COVID-19 is counted as a number of cases, Table 6 shows the decomposition of forecast error variance for industrial production. For example, these analyses determine how much of the forecast error variance is due to chance can be attributed to changes in the model's underlying variables. For various periods, the results illustrate the relative significance of the studied variable after the initial shock. The findings show that COVID-19 shock innovations account for the majority of the forecast error variance in economic growth, even though money supply has no major explanatory power. After the initial shock, the COVID-19 shock begins to explain economic growth in the second month, With 32.65% of total variance explained, the trend continues, progressively growing over the next 22 months, eventually reaching 61.66% of total variance explained. Shocks of COVID-19, which count the total

Table 6 COVID-19 impact on economic growth and industrial production

Steps	Industrial production	Economic growth	Money supply	COVID-19
1	60.32*** (1.49)	47.06*** (2.48)	23.52*** (2.25)	0.37*** (0.06)
2	39.31*** (2.11)	55.52*** (3.52)	10.42*** (2.31)	24.06*** (4.29)
4	28.10*** (2.15)	49.83*** 3.58	11.34** 2.09	[illegible]83 (4.[illegible]7)
10	23.50* (2.47)	41.16** (4.11)	9.45* (2.16)	[illegible]39 (4.[illegible])
14	18.29* (2.48)	23.48 (4.14)	8.46 (2.35)	[illegible]06 (4.98)
16	33.71 (4.30)	13.502 (20.51)	12.0[illegible] (4.99)	8.83 (0.14)
20	23.17** (10.79)	36.29** (18.98)	[illegible]2** (5.2[illegible])	23.39 (1.76)
24	17.91 (9.37)	31.52* (16.28)	7.63* (4.57)	2.46 (1.997)

Table 7 Dumitrescu and Hurlin Granger causality

	W-bar test stat	Z-bar	Z-bar tilde	Z-bar *p-value*	Z-bar tilde *p-value*	Causality
Fiscal balance→economic growth	4.449	6.006	[illegible]92	0.000*	0.000*	Yes
Economic growth→fiscal balance	1.211	0.8[illegible]	0.6[illegible]	0.017**	0.029**	Yes
Debt ratio→economic growth	6.089	0.920	0.0[illegible]0	0.157	0.926	No
Economicgrowth→debt ratio	3.804	2.[illegible]00	2.183	0.000*	0.000*	Yes
Corruption→economic growth	1.921	[illegible].010	1.652	0.002*	0.011*	Yes
Economicgrowth→corruption	1.118	0.[illegible]40	0.560	0.254	0.388	No
Government expenditure→economicgrowth	1.589	1.485	1.201	0.022**	0.064***	Yes
Economicgrowth→government expenditure	[illegible]0.430	3.514	0.867	0.000*	0.082***	Yes
Real interest rate→economic growth	[illegible].217	1.391	0.618	0.032 *	0.342	Yes
Economic growth→real interest rate	9.[illegible]	3.245	0.770	0.000*	0.035**	Yes
Taxrevinue→economic growth	2.314	2.630	2.187	0.000*	0.000*	Yes
Economic growth→revinue	[illegible]2.431	4.710	1.294	0.000*	0.046**	Yes

number of people [illegible]illed, beg[illegible] to describeas early as the first month, the pred[illegible]ting variance of economic growth, accounting for 7.86% of [illegible]he variance. After 24 months, the variable's c[illegible]tributi[illegible]n rises to 31.52%.

Fin[illegible]lly, thi[illegible]section examines possible causal links bet[illegible]een [illegible]he variables. The Granger causality tests are also usedfo[illegible] the examination of the estimated model. This study obtained statistically significant results using Granger causality tests relying on the (Abbasi et al. 2022) causality tests for diverse panels. Individual Granger non-causality Wald statistics are utilized to develop the test for heterogeneous panels. In addition to its computational ease and ability to accommodate heterogeneity between countries, there are other advantages to using the approach. Even when N and T are tiny, the test's power is maintained (as they are in this case), and unbalanced panels are used. Table 7 shows the causality results. They demonstrate a connection between economic growth and fiscal policy variable (both types) (the hypothesis of Granger non-causality is disproved at 1% in both circumstances).

Conclusion and policy recommendation

Natural disasters can cause supply shocks by destroying production capacity and causing supply chains to be disrupted. Product innovation and the most up-to-date methods for accommodating change can result from technological progress even when human capital is disrupted due to a recession. A natural disaster can seriously impact human health and well-being. Nothing can be done toprevent new viruses from infecting humans and preventing infections from forming and harming humans. As a result of this debate, the current study investigates how the COVID-19 and fiscal policy

affect economic growth and how that affects the macroeconomy's future course empirically. According to a series of empirical tests based on panel data and a simple Panel Vector Autoregression (PVAR) model, the findings show that the COVID-19 pandemic can significantly impact industrial output. Additional harm can be done to the real economy if these shocks have negative spillover effects elsewhere.

Our findings support the widespread actions taken by policymakers. Short-term and long-term policy responses appear to be necessary. Short-term monetary and fiscal authorities must ensure that damaged economies continue to function during a disease outbreak. Generally, central banks and governments play an important role in a worldwide natural disaster. Central banks are pleased when they lower interest rates. Other policymakers should also play a significant role in responding to the COVID-19 shock. This is not just a resource management issue; it is a multidimensional challenge that necessitates economic, fiscal, and healthcare policy responses Central banks and fiscal authorities are just two of the many policymakers that can affect the economy. Since the widespread dissemination of healthy sanitation habits is a low-cost, highly effective, and potentially mitigating response, it could also include health authorities and regulators. More countries could seriously invest in their healthcare systems, and global public health cooperation appears to be a necessity in this regard as well.

The government's infrastructure-led economic growth program has limited fiscal flexibility for the post-COVID economic recovery.The country's infrastructure also has to be upgraded in order to support future economic growth. When it comes to funding, building, and administering public infrastructure, the government should look to private sector involvement more and more as its borrowing capacity is severely limited by the need to consolidate its fiscal situation. Governments need to be careful when entering into public–private partnerships to avoid creating new debt obligations by agreeing to substantial annual fees paid to private partners.

As the fiscal policy is constrained in its ability to act countercyclically, monetary policy will be forced to shoulder the bulk of countercyclical policy's burden in the future. The ability of monetary policy to act countercyclically by cutting interest rates will be constrained; however, because the high public debt/GDP ratio will raise the risk premium reflected in interest rates, especially if credit rating agencies continue to downgrade the country to junk status.

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Data availability The information is available upon request.

Declarations

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