



# The Determinants of Fiscal Deficit in South Africa: A Bayesian Vector Autoregressive Approach

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## ABSTRACT

This study empirically investigates the factors influencing South Africa's fiscal deficit from 1975 to 2021. The research design used the Bayesian vector autoregressive estimation with the Minestor prior. The findings are analysed using the impulse response function and variance decomposition. The findings revealed that government debt, GDP growth, money supply, and interest rate as determinants of the fiscal deficit. Impulse response functions showed positive and significant impacts of government debt on the fiscal deficit; negative and significant impacts of economic growth, money supply, and interest rate on fiscal deficits. The variance decomposition showed that economic growth and national debt explained the variations in fiscal deficit in the long run. The relationship between macroeconomic factors and fiscal deficit could have social consequences for the even distribution of resources, equitable growth, and overall welfare. This study contributes to the limited literature on the macroeconomic determinants of fiscal deficit in the South African economy and Africa at large.

**Keywords:** Fiscal Deficits, South Africa, Economic Growth, Government Debt, Fiscal Balance, Bayesian

**JEL Classifications:** E62, E63, H61, H62, H63

## 1. INTRODUCTION

A persistent issue in many developing economies is the occurrence of a fiscal deficit. Tevdovski et al. (2021) explained that the majority of countries across the globe have government expenditures that are higher than their tax revenue. This difference often leads to a negative balance between government revenue and expenditure, referred to as a fiscal deficit. A fiscal deficit is generally accompanied by a surge in public debt, which makes the subject of fiscal deficit crucial to economic growth.

Shebu and Adamu (2021) suggested that a significant fiscal deficit and the accompanying public debt can result in an inefficient allocation of resources in a society. The process of public debt repayment can become an obstacle to production and give rise to crowding-out effects. Additionally, a fiscal deficit may be attributed to an economy's increasing inflation rate, declining growth rate, current account deficit, and investment and consumption crowding out.

Persistent fiscal deficits can potentially hinder economic growth and development within an economy. In a monetarist framework, deficits tend to be inflationary because when monetisation takes place, it leads to an increase in money supply and, ceteris paribus, an increase in the rate of inflation, in the long run (Tule et al., 2019). The situation is worsened in the post-COVID-19 era, where governments are recovering from the large expenditure to manage the adverse effects of the pandemic, (Makin and Layton, 2021).

Various schools of thought have debated the role of fiscal deficits, leading to different conclusions. On the one hand, Keynesian economists, such as Keynes (1936) and Kustepeli (2005), emphasise the importance of government intervention in ensuring the success of a nation's economy. In addition, Musgrave (1959) stressed the significance of fiscal policy for improving social welfare. On the other hand, economists from classical to public choice advocate against using fiscal deficits to improve economic performance. Smith (1776), Ricardo (1817), and Pigou

(1912) specifically warn that government interference can lead to economic instability.

Empirical data in South Africa has shown the persistence of fiscal deficit as government expenditure exceeds government revenue. The South Africa Reserve Bank (2022) data has shown a worsening fiscal deficit, especially after the 2008 financial crisis. Before the 2008 financial crisis, the government had implemented more fiscal discipline with an average fiscal deficit-to-GDP of  $-0.8\%$  between 2000 and 2007 (peaking with a surplus of  $0.7\%$  in 2007). However, after the 2008 financial crisis, the fiscal deficit to GDP began falling again, with an average of  $-3.7\%$  of GDP between 2008 and 2018. The COVID-19 pandemic escalated the growing deficit, increasing the deficit to  $-9.5\%$  of GDP, the highest recorded deficit for the period under investigation (1975-2021). The sharp increase in fiscal deficit in 2020 is attributed to the increased government spending to mitigate the adverse effect of the pandemic and the ensuing lockdown periods.

Aero and Ogundipe (2018) explained that the significance of fiscal deficit is its impact on the national debt and economic growth. In the South African case, the improved fiscal deficit period (2000-2007) coincided with a decreased debt of  $24\%$  of GDP and economic growth of  $3.1\%$  in 2007. After the 2008 financial crisis, the worsening fiscal deficit was accompanied by increased debt, peaking at  $69\%$  of GDP and a shrinking economy growth rate of  $-6.4\%$  (SARB dataset, 2022). The significance of fiscal deficit to an economy cannot be overemphasised as it impacts macroeconomic stability. It is, therefore, crucial to understand the determinants of fiscal deficit to maintain economic stability. This significance of fiscal deficits has motivated the research question for this study: What are the economic determinants of fiscal deficit in South Africa?

This study aims to contribute to the limited country-specific research on the fiscal deficit. In South Africa, only a handful of studies have investigated the determinants of fiscal deficit, and this study fills in this gap by focusing on specific macroeconomic variables. Additionally, the study used the Bayesian Vector Autoregressive (BVAR) estimation technique to identify the economic determinants of fiscal deficits in South Africa. The benefit of the BVAR is that it is objective and does not suffer from the issue of over-parametrisation that is prominent in the regular VAR models. Secondly, the BVAR accounts for unit roots using the Litterman Minnesota prior to provide a more accurate estimation. The BVAR estimation results will be interpreted using the impulse response function and the variance decomposition. Osundina et al. (2018) explained that, on the one hand, impulse response functions show the response of fiscal deficit to a shock in any of the determinant variables on the specified time horizon. On the other hand, the variance decomposition illustrates the relative significance of different shocks to the variation in the determinant variables.

This study is structured as follows section 2 provides the theoretical and empirical literature review on fiscal deficit. The focus of the empirical literature is on countries similar to South Africa. Section 3 discusses the methodology and specifies the

equation with the fiscal deficit as a dependent variable. Section 4 presents the empirical findings using impulse response function and variance decomposition. Section 5 concludes this study.

## 2. LITERATURE REVIEW

### 2.1. Theoretical Literature

Early theoretical literature espoused by Keynes (1936) advocated for government intervention and fiscal policy to enhance social security and maintain economic stability. He embraced the theory that economies were inherently unstable but could achieve full employment through government policy and public investment. During a financial crisis, the government had the onus to bridge the gap between the economy's potential and actual output.

Classical economists, on the other hand, posited that fiscal deficits deter economic growth. Economists such as Smith (1776) and Pigou (1912) suggested that government intervention is the primary source of macroeconomic instability. Buchanan and Tullock (1962) asserted that the primary purpose of fiscal policy should be to maximise social welfare; however, policymakers used fiscal policy to maximise their personal welfare and utility instead. Furthermore, the Ricardian equivalence theorem by Ricardo (1820) added that fiscal policy focuses only on government expenditure and not the method of finance (taxation revenue or borrowing), which has economic implications. This assertion suggests that economic agents do not differentiate between government borrowing at present or an increase in taxes in the future.

The Tax-smoothing hypothesis posited that governments strive to minimise the adverse effects of taxes by allocating them over time (Barro 1979; Lucas and Stokey, 1983). The underlying assumption of the hypothesis is that the expected change in the ratio of government expenditure to GDP leads to fiscal imbalance (surplus or deficit). The model assumes that the government can issue default-free bonds to help smooth tax rates over time (Turan et al. 2014). To achieve this, governments should use fiscal deficits and surpluses.

Tymoigne and Wray (2013) explain that the Modern Money Theory suggests that a sovereign government cannot hold a government surplus. According to the theory, a government surplus has a detrimental effect on private savings and growth because it prevents the private sector from saving due to higher taxes and less government spending. Magazzino (2016) added that persistent surplus is not desirable in many countries because government debt plays a constructive role in modern economics. However, the theory cautions that fiscal deficits must be monitored and controlled.

### 2.2. Empirical Literature

Javid et al. (2011) studied selected Asian countries and utilised panel regression. Their findings revealed that budget instability was linked to increasing domestic income, escalating inflation, and a growing fiscal deficit-to-GDP ratio. Moreover, external shocks led to greater volatility in fiscal deficits. In contrast, countries with a growing population experienced less unstable fiscal deficits. The research suggested that democracy and political stability, along with progress in social and economic conditions, can lessen fiscal deficit instability. The study also concluded that political and

institutional factors significantly influence fiscal volatility beyond economic causes that bring about fluctuations.

Maltritz and Wüste (2015) conducted a study for a panel of 27 European countries covering 20 years. The study aimed to determine the factors that affect fiscal deficits. Results showed that government debt positively impacted the fiscal deficit, while the inflation rate, unemployment rate, real GDP, and election year negatively influenced fiscal deficit. Also, the authors discovered that fiscal rules and stock-flow adjustments significantly affected the fiscal deficit.

Gnimassoun and Do Santos (2021) applied the Extreme Bound approach to study public deficits in a panel of developing countries. The authors found that external economic shocks, national debt, the degree of financial development, and a democratic regime have a significant impact on public deficits.

Mawejje and Odhiambo (2021) presented an investigation into the dynamic relationship between fiscal deficit and selected macroeconomic variables for a panel of five East African Community countries (EMU). Using a panel error correction model, the authors found evidence of cointegration between fiscal deficit and the explanatory variables. However, in the short run, Granger causality existed only between fiscal deficit and economic growth.

The study conducted by Anwar and Ahmad (2012) focused on Pakistan by investigating the impact of political factors on fiscal deficits. The author used the bound test, which revealed a significant correlation between political variables such as democracy and cabinet size and the long-term trend of fiscal deficits. Furthermore, the study found a direct relationship between the size of the government and the magnitude of fiscal deficits. Kalim and Hassan (2013), using a log-linear model for Pakistan data, found a short-run association between economic growth and fiscal deficit; however, this association is insignificant in the long run. In addition, money supply, national debt, and international trade also significantly impacted the short and long term fiscal deficit.

Sadekin et al. (2020), using trend analysis for Bangladesh, found that government financing is a significant determinant of fiscal deficit. Alam et al. (2020), using a VECM approach, found that inflation, exchange rate, trade, and money supply had a negative effect on fiscal deficit in the short run but a positive association in the long run.

Studies by Akinboade (2004), Agha and Khan (2006), Combes and Saadi-Sedik (2006), Edame and Oki (2015), and Aero and Ogundipe (2018) assessed the impact of a specific macroeconomic variable on fiscal balances. Akinboade (2004) analysed the association between interest rates and fiscal deficits in South Africa. The study found no causal association between fiscal deficits and interest rates, shown by independent Granger causality test results. Agha and Khan (2006) empirically analysed the impact of inflation on fiscal imbalances in Pakistan. They found a nexus between money supply, fiscal deficit and inflation in the short and long-run relationship.

On the other hand, Combes and Saadi-Sedik (2006) focused on the association between trade openness and fiscal deficit for a panel of 66 developing countries. They found an inverse relationship between trade openness and fiscal balances; the rate of urbanisation and GDP were significant determinants of fiscal surpluses. Oladipo and Akinbobola (2011) investigated the impact of fiscal deficit on economic growth through inflation. They found the presence of unidirectional causality from deficit to inflation. Edame and Oki (2015) studied the relationship between fiscal deficit and economic growth using a Chow test in Nigeria. The authors found that fiscal deficit had a significant impact on GDP growth during the military regime but did not have the same effect during the democratic regime. In a similar study of the Nigerian economy, Aero and Ogundipe (2018) revealed an inverse relationship between fiscal deficit and economic growth.

In Nigeria, Shebu and Adamu (2021) explored the determinants of the fiscal deficit using the VECM approach. The results revealed the presence of cointegration in the model. Furthermore, the study found exchange rate, interest, and precious deficits to be the significant determinants of fiscal deficits.

Murwirapachena et al. (2013) conducted a study in South Africa to explore the economic determinants of fiscal deficits from 1975 to 2010. The study utilised the VECM estimation to show the impact of macroeconomic variables such as unemployment, economic growth, public investment, foreign reserves and foreign debt on fiscal deficits. The study concluded that the variables mentioned above positively impacted fiscal deficits, except for foreign debt, which had a negative impact. However, the study only considered foreign debt and not national debt; as such, the study only accounted for the partial impact of debt. Furthermore, the authors used the log of GDP as a proxy for economic growth, which may provide inaccurate outcomes since economic growth is a yearly change in GDP. Finally, the VECM analysis used in the study did not consider prior information to produce regression results. It is important to note that government debt plays an essential role in determining fiscal balance according to economic theory.

In a conference paper, Mah (2018) built on the work of Murwirapachena et al. (2013) by examining the determinants of fiscal deficit in South Africa. Mah (2018) used the bounds tests to reveal a positive association between lagged deficits, GDP, and fiscal deficits. The exchange rate and deficits have a negative association. The study recommends that policymakers reduce the fiscal deficit to improve the exchange rate. As this is a conference paper, it does not provide an in-depth analysis of the subject. As such, the results should be interpreted with caution.

Based on the literature review, it has been found that research on factors that determine fiscal deficits in sub-Saharan Africa is limited. The present research aims to contribute to the limited amount of country-specific research on the fiscal deficit, focusing on macroeconomic factors relevant to South Africa. The research has used yearly data from 1975 to 2021, providing sufficient frequency for analysis. A Bayesian Vector Autoregressive (BVAR) model has been utilised to estimate the relationship between fiscal deficit and its determinants, which does not suffer from the

over-parameterisation that is prominent in other VAR models. The BVAR approach has been proven to produce accurate forecasts and improve out-of-sample performance Das, et al. (2009).

### 3. METHODOLOGY

#### 3.1. Empirical Model

The empirical model of this study stems from the tax-smoothing hypothesis since the hypothesis focuses on the fiscal deficit/surplus of economies. Equation 1 follows the methods of Murwirapachena et al. (2013), Mah (2018), and Mawejje and Odhiambo (2021) and has been modified only to consider economic variables and is specified as follows:

$$BD = f(\text{debt}, \text{ec}, \text{inf}, \text{rr}, \text{ms}) \tag{1}$$

Where:

- FD = Fiscal deficit
- ec = Economic growth,
- inf = Inflation rate,
- rr = Interest rate,
- ms = Money supply,

The Bayesian VAR specification of equation 1 is presented as:

$$Y_t = c + A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + \mu_t \tag{2}$$

Where  $Y_t$  is the dependent variable of fiscal deficits, and  $Y_{t-p}$  is the matrix of explanatory variables of the righthand side of equation 1. The following matrix is:

$$Y_t = \begin{pmatrix} \text{debt}_{i,t} \\ \text{ec}_{i,t} \\ \text{inf}_{i,t} \\ \text{rr}_{i,t} \\ \text{ms}_{i,t} \\ \text{trade}_{i,t} \end{pmatrix}$$

Minnesota prior in this study is set such that the value of the overall tightness parameter ( $w$ ) is equal to 0.1 and set the harmonic decay parameter ( $d$ ) is equal to 1 for the five-variable BVAR model for an initial prior from 1975 to 2021. This study used the “Minnesota prior” because it is successful in many forecasting applications (Koop and Korobilis, 2009). Another advantage of this prior is that it leads to simple posterior inferences involving normal distributions following the work of Doan et al. (1984), also used in South Africa by Gupta and Sichel (2006), Gupta (2007) and Gupta et al. (2012). Prior distributions for the BVAR parameters are assumed to be independent normal distributions, with their means set equal to zero and small standard deviations.

#### 3.2. Data

The author collected and used data from the South African Reserve Bank (SARB) website and World Bank development indicators. This study used yearly data from 1975 to 2021, as described in Table 1.

## 4. EMPIRICAL RESULTS

### 4.1. Pre-estimation Checks

The ADF and KPSS tests in Table 2 show that the variables became stationary after the first differencing, which implies stationarity of order (I). The KPSS test provided a robustness check against the ADF since the two tests have different null hypotheses. The KPSS test assumes the series is stationary as a null hypothesis, and the ADF hypothesis is that the series contains a unit root.

### 4.2. Structural Breaks Test

The results of the multiple breaks showed that the data compromised five structural breaks in the years 1987, 1993, 2003, 2010, and 2020. The dates correspond with the worsening fiscal deficit data. The 2020 structural break is attributed to the increased expenditure acquisition of personal protective equipment, the covid relief grant, and the acquisition of vaccines) to combat the adverse effect of the coronavirus pandemic. The year 2010 comes after the election year of 2009 when the government increase expenditure on elections (printing of ballots, campaigns). In order to safeguard the degree of freedom, this study accounts for the 2010 and 2020 structural breaks using dummy variables.

### 4.3. Empirical Results

The study presented the results of the BVAR estimation using the Impulse Response Functions (IRF) and variance decomposition. The IRF in Figure 1 shows the direction of association between any two variables. It should be noted that the primary balance is defined positively and not in terms of deficits, as the study has discussed. Maltritz and Wuste (2015) explained that “a positive sign of budget balance indicates a surplus and negative indicates

**Table 1: Description of variable**

Variable	Description	Source
FD	National government deficit/surplus as % of GDP	SARB
EC	Economic growth (%)	World development indicators
INF	Inflation, GDP deflator (annual %)	World development indicators
Debt	Total gross government loan debt as % of GDP	SARB
RR	Real interest rate (%)	World development indicators
MS	Broad money (M2) as % of GDP	World development indicators

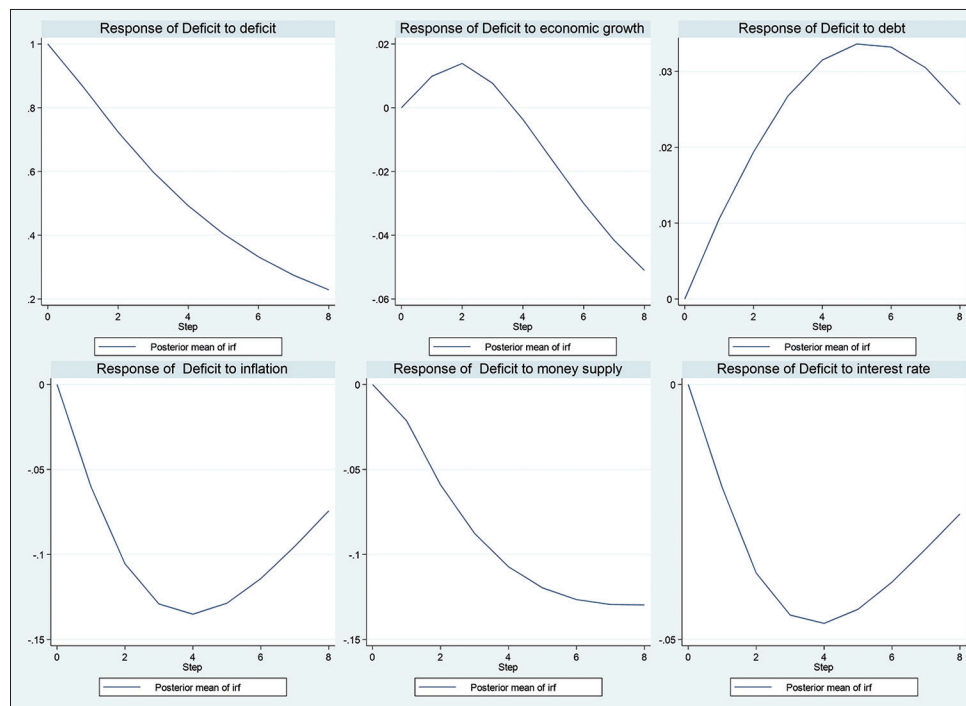
Source: Authors’ compilation. SARB: South African Reserve Bank

**Table 2: Unit root test results**

Variable	ADF		KPSS	
	Level	1 <sup>st</sup> difference	Level	1 <sup>st</sup> difference
BD	-2.44	-5.64*	0.1	0.16*
EC	-4.14	-7.07*	0.14	0.14*
INF	-1.73	-3.55*	0.14	0.14**
Debt	-1.82	-3.38*	-0.1	0.1**
RR	-5.27	-8.55*	0.16	0.08**
MS	-0.57	-3.54**	0.2	-0.05**

Authors’ computation. Note:\*\* is stationary at 5%, \* is stationary at 1%

Figure 1: Impulse response function



Source: Authors' computation

deficits.” Therefore, the directions (sign) of the IRF indicate the expected sign of the budget balance.

The IRF shows that national debt positively impacts the primary balance, thus decreasing fiscal deficits. Maltritz and Wuste (2015) assert that high debt implies that government has less flexibility for spending, while low debt levels encourage governments to spend and run deficits. However, after the peak in the fifth period, essentially 5 years, the response of fiscal deficit to a shock in debt remains positive but starts declining.

Furthermore, the primary balance reported a positive response to a shock in economic growth until the 4<sup>th</sup> year. This finding implies that economic growth has a positive impact on the budget balance, thus decreasing fiscal deficit in the short run. This finding follows theoretical underpinnings, and the results imply that Murwirapachena et al. (2013) found a positive association between economic growth and GDP. However, sustained economic growth has a negative impact on fiscal deficit.

Inflation exerts a U-shaped response in fiscal deficit such that the inflation rate has an inverse association in the first 4 years. However, after the 6<sup>th</sup> year, the response of the deficit to inflation is positive. The results revealed an inverse association between fiscal deficit and interest rate. When interest rates increase, the budget balance worsens, increasing deficits following theoretical expectations. A higher interest rate will increase capital costs, discouraging debt. In the long run, the impact seems to improve albeit negatively, showing that the continuous repayment of debt at an interest rate implies less fiscal space and thus improves the budget balance.

The response of the money supply leads to a negative response in the fiscal deficit. Increasing the purchase of goods and services will

increase aggregate income and improve the deficits. An increased money supply tends to increase consumption expenditure without cost.

The study found trade openness to have a negative impact on the deficit (Combes and Saadi-Sedik, 2006). International trade opens the domestic economy to external shocks, which could cause governments to change their fiscal stance following the Dutch disease hypothesis.

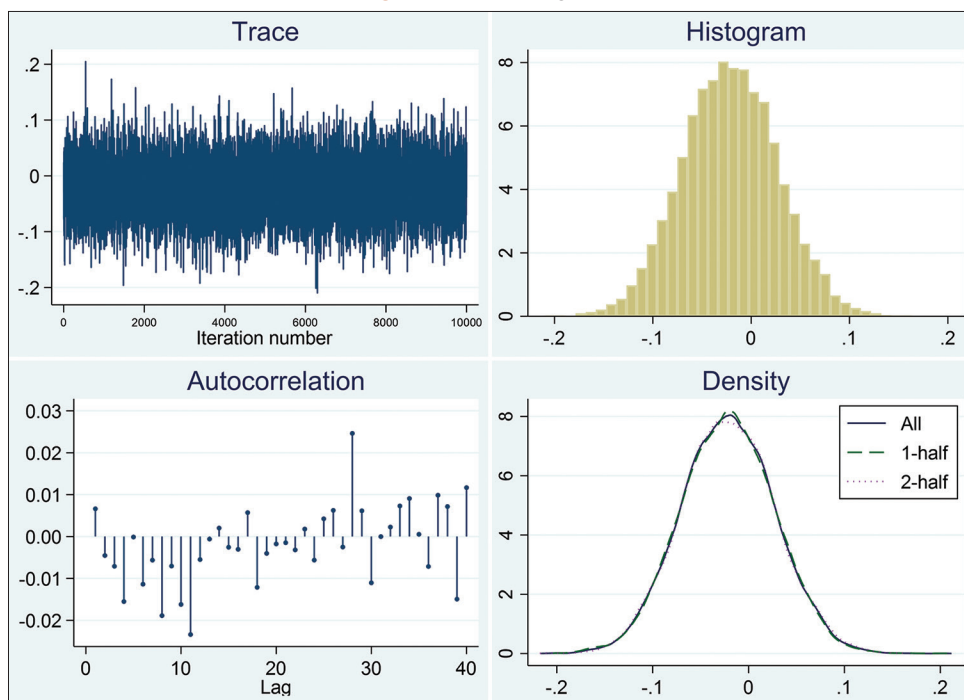
#### 4.4. Variance Decomposition

The variance decomposition analysis for the endogenous variables reveals how much of a fiscal deficit's change is caused by its “own” shock and how much is impacted by the shocks of the explanatory variables. Table 3 further displays the ratio of fluctuations in the data that can be attributed to other variables throughout 10-period horizons.

Table 3 showed that more than 90% of the variations in fiscal deficit are significantly explained by its own previous values for the first 5 years, indicating significant self-propelling impacts in the short run. Moreover, Table 3 shows that over time, the variation of fiscal deficit is explained by national government debt at 10% and economic growth at 9%. This implies that debt and economic growth are the most significant determinants of fiscal deficit in the long run.

The remaining variable of inflation, money supply, and interest rate explains a minimal and insignificant variation in deficit. Finally, the variance decomposition analysis shows that “own shocks” are the largest source of variations in fiscal deficit in South Africa and that the macroeconomic variables investigated in this study explain the variations in the fiscal deficit.

Figure 2: Model diagnostic



Source: Authors' computation

Table 3: Variance decomposition of fiscal deficit

Period	SE.	DEFICIT	DEBT	EC	INF_CPI	MS	RR
1	1.01	100.00	0.00	0.00	0.00	0.00	0.00
2	1.71	99.28	0.20	0.40	0.03	0.00	0.08
3	1.95	97.50	0.71	1.37	0.10	0.03	0.29
4	2.10	94.89	1.55	2.73	0.14	0.13	0.57
5	2.21	91.76	2.68	4.26	0.15	0.27	0.86
6	2.28	88.45	4.05	5.76	0.20	0.41	1.13
7	2.34	85.21	5.56	7.04	0.24	0.61	1.34
8	2.39	82.22	7.11	8.02	0.28	0.88	1.49
9	2.43	79.60	8.61	8.66	0.52	1.02	1.58
10	2.47	77.38	10.00	9.00	0.77	1.22	1.62

Source: Authors' computation

Table 4: BVAR stability test

Eigenvalue modulus	Mean	Std. dev.	MCSE	Median	Equal-tailed (95% cred. Interval)
1	1.09	0.05	0.00052	1.08	0.992 1.189
5	0.84	0.07	0.00066	0.84	0.699 0.952
10	0.11	0.03	0.00028	0.11	0.065 0.173
14	0.03	0.02	0.00018	0.03	0.001 0.068

\*Pr (eigenvalues lie inside the unit circle) = 0.0398. BVAR: Bayesian vector autoregressive

#### 4.5. Model Diagnostics Test

Figure 2 shows that the BVAR is stable because the model is stable indicated by the Trace graph. The model is normal and equal distribution indicated by the histogram and *k*-density graphs. Lastly, autocorrelation is negligible, indicating a relatively well-behaved model.

Table 4 shows the BVAR stability test indicated by the eigenvalue modulus. The table has been short brevity and indicates that the BVAR is stable since all the eigenvalues lie inside the unit circle.

## 5. CONCLUSION

The main objective of this study was to identify the determinants of fiscal deficit in South Africa. The IRF of this study found a negative relationship between fiscal deficit and inflation, interest, and money supply. These results are echoed in the literature by Murwirapachena et al. (2013), Kalim and Hassan (2013) and Anwar and Ahmad (2012). The variance decomposition showed that the fiscal deficit is explained by itself in the short run (<5 years). Moreover, only debt and economic growth significantly explain the variations in fiscal deficit after 10 years.

Based on the findings, it is recommended that the government focuses on promoting economic growth in order to expand the tax base and generate more revenue. This can be achieved by increasing people's income, resulting in higher VAT revenue and more employment opportunities. Additionally, the government should reduce its spending across various departments, particularly in areas where it is not necessary. The advantages of cutting down government expenditure will also lead to lower interest rates and encourage investment from the private sector. The government must take these measures to reduce the fiscal deficit and repay debt.

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