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Elisha Mavodyo

Abstract South Africa has experienced high budget deficits accompanied by sluggish economic growth over the years. Fears mount that such a trend may worsen due to the advent of the Covid-19. Yet, the effect of budget deficit on economic growth remains one of the widely debated topics in economics. This article gives empirical evidence on the budget deficit-economic growth nexus and the deficit spending channels that are growth stimulating in South Africa over the period 1980 to 2018. Relying on the Dynamic Ordinary Least Squares (DOLS), results show that budget deficit is growth promoting and that budget deficit is growth stimulating if it is channelled towards export-oriented industrialisation of ores and metals.

Keywords: DOLS; endogeneity; budget deficit; economic growth; export-oriented industrialisation

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A Revival of Budget Deficit and Economic Growth

1: Introduction

In October 2019, the South African Finance Minister, Mr. Tito Mboweni, released a medium-term budget that showed slowing growth, a rising budget deficit. The South African Treasury also cut its 2019 growth estimate to 0.5 percent from the previous 1.5 percent forecast. The government's fiscal deficit is expected to be at a staggering 5.9 percent of GDP, up from the 4.5 percent forecasted in February and the highest since the fiscal year 2009/10. Large fiscal deficits in the next two years are expected to push government debt to 70 percent of GDP by the fiscal year 2022/23, up from 60 percent in 2019 (Oxford Analytica, 2019). Further to this deteriorated economic outlook for South Africa, the adverse economic effects of the Coronavirus are likely to trigger recessions of historic proportions since the great depressions of the 1930s (Sohrabi et al, 2020 and Wenham et al, 2020). In South Africa, like in any other country in the world, government revenues are expected to fall drastically due to the Covid-19 associated decline in economic activity and in commodity prices (LaHue, 2020 and Forrester, 2020). The government expenditure side is not even promising as well. In order to denigrate the unfavourable impact of Covid-19, just like in any other country, the South African government has instituted a wave of socio-economic policies and measures, including but not limited to, suspension of non-essential economic activities, increased government spending in health sector and in social safety nets, accommodative tax measures, accommodative stimulus packages and accommodative monetary policies. These policies and measures have protracted effects on South Africa's fiscal positions and may spark an upsurge of soaring budget deficits (Zhong, 2020). Against this backdrop, two paramount questions deserve some attention. First, there is need to ascertain as to the likely impact of budget deficit on economic growth over the

ensuing years in South Africa. Second, if budget deficit is growth stimulating, the next important contentious issue is the need to provide empirical evidence on the channels through which budget deficit is beneficial to economic growth. Nonetheless at the time of writing, I am not aware of any previous work that has done any work to help provide clarity on the above crucial questions. I need to point out, at the onset, that the impact of the Covid-19 on economic activity is not captured in the data as my sample size spans from 1980 to 2018, but the fact that the Covid-19 has made a study like mine more relevant than ever, may not be disputable (Lucas, 1988.)

It is natural for one to enlist the guidance of economic theory to have an idea of the likely impact of one economic variable on another. Nonetheless, economic theory is not conclusive with regards to the causal relationship of budget deficit and economic growth. The study of budget deficit on economic growth invoked controversy and divisiveness, leading to two discernible camps. For some, budget deficit is viewed as being corrosive to economic growth, (Solow, 1956; Mankiw et al. 1992; Islam, 1995b) while for others, (Keynes, 1936; Harrod, 1939; Domar, 1946;) budget deficit is perceived as growth stimulating. Depending on whichever side one is on, but one will find that the Covid-19 will rage the debate, argument, and dissent even further.

Up to now, one may be wondering as to why I have discriminated in favour of South Africa of all the countries particularly in Sub-Saharan Africa. I proffer the following reasons in my line of defence. First, South Africa is the economic giant of Southern Africa to the extent that economic downturn in South Africa may have contagion effects in the rest of Southern Africa (Nganje, 2014; Saurombe, 2014). Second, growth has remained subdued at 0.4 percent as South Africa was still recovering from the adverse economic effects of the global financial crisis. This makes South Africa an interesting subject of empirical study.

Considering the disunity in the literature on the subject matter under discussion, the likely injurious impact of Covid-19 on budget deficits and economic growth, the economic role South Africa plays in Southern Africa, and the apparent lack of empirical evidence on the channels through which budget deficit is associated with higher growth rates, I find this study more pertinent than ever.

Whilst most studies have gone as far as providing an empirical evidence on the relationship between budget deficit and economic growth but I am not aware of any that has gone further than providing empirical evidence on the channels through which budget deficit is growth stimulating, an aspect I feel is the greatest strength of this article. I argue, in this article, that knowing whether budget deficit is injurious or beneficial to economic growth is one thing and exploring the channels through which budget deficit is associated with future economic growth, is another. Accomplishing the tasks above gives a clearer policy suggestion, an aspect I feel a notable novelty of this article, compared to its predecessors.

To present an anecdotal relationship between budget deficit and economic growth over the period under my study, I provide an evolution of budget deficit and economic growth over the period 1980 to 2018 in the next subsection.

Budget Deficit and Economic Growth Evolution in South Africa (1980-2018)

The South African economy went through remarkable episodes that help shape the upswings and downswings in both budget deficit and economic growth over the period under analysis. Some of these episodes include, but not limited to, the dawn of democracy in 1994, the negative impact of the global financial crisis in 2008/2009 and the drought of 2015/2016. I present a graphic representation of the relationship between budget deficit and economic growth in Figure 1 in South Africa. Although the relationship may not be taken seriously but it reveals a positive co-movement between budget deficit and economic growth.

The period between 1980 and 1985 is characterised by a slow-down in both economic growth and budget deficit. Another noticeable period is between 1994 and 2007 where both budget deficit and economic growth were on an upward trajectory. A plausible explanation to this upward trend could be due to the positive effects of the macroeconomic policies put in place by the new democratic government. As is true with any Sub-Saharan African country, a post democratic period is characterised by excessive government spending to redress the social imbalances inherited from the pre-democratic government.

2: Literature review

The focus of this section is to give a brief overview of the theoretical schools of thought that explain the relationship between budget deficits and economic growth to put my analysis into its proper context. Pursuant with this goal, it is not my intention to delve into a full scale of the subject matter as I am constrained by both time and space. I refer the reader to the original pieces of work.

Discussion around the impact of budget deficit on economic growth was sparked by the federal deficits of the 1980s (Shaviro, 1997), resulting in two distinct camps. The first camp is the Keynesian school whose central theme is that economic systems do not necessarily turn to full employment but the autonomous components of aggregate demand affect the rate of growth of the economy (Harrod, 1939; Domar, 1946; Keynes, 1936). Of particular importance to mention is a group largely known as the new Keynesian growth model (Campbell and Mankew, 1989; Gali et al, 2007; Commendatore et al, 2001.) which is centred on rule of thumb consumers who, due to myopia, lack of access to capital markets, fear of saving, and fear of intertemporal trading opportunities, are assumed to consume all of their current income and never save nor borrow. The central conclusion from any variant of Keynesian economics is that budget deficits are beneficial to economic growth.

Contrary to Keynesian perspective on the impact of budget deficits on economic growth, is the neoclassical perspective which strongly argue that budget deficits are corrosive to economic growth (Solow, 1956; Shaviro, 1997; Barth et al, 1984; Sharipov, 2015). I find it necessary to point out that the Solow (1956) growth model gives an ideal theoretical base for my data generating process that suits well my estimation technique in the subsequent sections. Overall, the neoclassical growth theory argues that budget deficits are corrosive to long-run economic growth. Of important to note, though is the conclusion by Bart et al (1984) who pointed out that the effects of budget deficit on economic growth are not clear and dissimilar, as not all deficits have homogeneous economic effects. It is apparent from a cursory discussion above that literature does not provide a conclusive causal relationship between budget deficit on long run economic growth. Without an empirical analysis, therefore, the likely effect may remain a subject of speculation and debate.

Having accomplished the task above, I now focus on similar previous work and the major conclusions their empirical work revealed with the intention of comparing my findings with its peers. There are diverging findings on the empirical relationship between budget deficit and economic growth. Several studies have been done for both developed and developing countries relying on different estimation techniques in both a panel and time series framework. It is not the intention of this study to provide an exhaustive account of the empirical findings as this motive is not only tedious, time consuming but also space constrained.

I therefore briefly present a discussion of a few examples of studies where budget deficit was detrimental to economic growth. Just recently, Dichachim (2020) provided empirical evidence to the effect that budget deficit is corrosive to economic growth for 20 Sub-Saharan African countries. The author made use of Pooled Mean Group estimator. Earlier Cinar et al (2014), used quarterly data for European countries, making use of the Panel Auto Regressive Dynamic Least Squares. The authors provided evidence confirming of a negative

relationship between budget deficit and economic growth in the short run though the relationship turned out to be positive in the long run.

Contrary to evidence providing a negative relationship, several studies provided evidence in support of the Keynesian school of thought. Studies such as those by Cinar et al (2014), Despotovic and Durkalic (2017), Saleh and Harvie (2005) and Molocwa et al (2018) are some of the several studies whose results confirmed of a positive relationship between budget deficit and economic growth.

The conclusion that can be drawn from the above discussion, is that, both the theoretical and empirical literature are not conclusive on the relationship between budget deficit and economic growth. The only option, therefore, is to undertake a country or panel specific study to ascertain the nature of relationship between budget deficit and economic growth. I provide a discussion of the methodology that I make use of in arriving at the empirical evidence on the relationship between budget deficit and economic growth in South Africa, in the next section.

3: Methodology

I find it worthwhile to clearly restate my goals in this article, as follows. First, since economic theory is inconclusive about the impact of budget deficit on economic growth, I intent to empirically provide evidence on the causal relationship between budget deficit and economic growth in South Africa. Second, I intent to empirically ascertain the channels through which budget deficit positively impact on economic growth. To achieve these goals, I need data on gross domestic product per capita (GDP)- which enters the regression function in logarithm form. My sample size is from 1980 to 2018, leading to 38 observations. I draw on a selected determinants of economic growth as guided by the previous work by Woo and Kumar (2015); Fincke and Greiner (2015a); Sala-I. Martin et al (2004); and the suggestion by Bosworth and Collins (2003) as control variables in my regression function. These control

variables are gross fixed capital formation as a percentage of GDP as well as consumer price index (cpi), which, like gdp per capita, enters the regression function in logarithmic form. The three variables above are sourced from the World Bank Development Indicators. My explanatory variable of interest, budget deficit, is sourced from the South African Reserve Bank's statistical online query, described as budget deficit or surplus as a percentage of GDP.

My growth analysis in this section is rooted in the endogenous growth model whose strong understanding is that long-run economic growth is generated from within the system. I therefore estimate the empirical model specified below:

$$\log GDP_t = \vartheta_0 + \vartheta_1 BD_t + \vartheta_2 GFC_t + \vartheta_3 \log CPI_t + \varepsilon_t \quad (1)$$

In equation 1, $\vartheta_0, \vartheta_1, \vartheta_2, \vartheta_3$ are the regression coefficients with ϑ_1 being the regression coefficient of interest which will help this article to arrive at the relationship between budget deficit and economic growth. My coefficient of interest, ϑ_1 , can either be positive or negative, depending on the impact of budget deficit on economic growth, as discussed above, and ϑ_2 is expected to carry a positive sign. The coefficient for consumer price index can either be positive or negative. In most cases it is expected to be negative, but it may be positive if the level of inflation is too low to have a negative impact on macroeconomic fundamentals. Lastly, ε_t , is the error term which is assumed to follow a normal distribution with a mean of zero and a constant variance.

As is standard procedure in applied econometric research, I subjected the data used in this article to preliminary-test inference. The merits of preliminary-test inference have a long history in econometric modelling. Motivated by the remarks of Berkson (1942), Bancroft (1944), aptly put it that preliminary-test inference is essential to investigate the statistical properties of sequential estimation strategies. More recently, Giles and Giles (1993) and Pignat

et al (2014), among others, assert that pre-estimation tests are important to locate anomalies and apply countermeasures.

Considering my research goals, the sampling properties of the data used in this article, and the apparent econometric endogeneity problem characteristic of growth regressions, I find no other estimator to be more appropriate than the Dynamic Ordinary Least Squares (DOLS) proposed by Stock and Watson¹ (1993). The endogeneity problem in growth regressions has been well underscored in applied econometrics literature (Seleteng et al., 2013; Bittencourt, 2012). Economic endogeneity can arise from an explanatory variable which is correlated with the error term, omitted variables and by simultaneous causality (Wooldridge, 2002; Chenhall and Frank, 2007). In view of the apparent endogeneity problem, I rely on the Dynamic Ordinary Least Squares (DOLS) by Stock and Watson (1993). Mansson et al (2018) argue that the DOLS can combat the multicollinearity problem and the finite sample bias of ordinary least squares caused by endogeneity. As a remedy to the problem of bias in small samples, Stock and Watson (1993) suggested the dynamic ordinary least squares (DOLS) estimator where the design matrix does not only consist of the explanatory variables but also first differences of the leads and lags of the regressors. This method solves the issue of endogeneity and it is denoted the dynamic OLS estimator. The DOLS is appropriate for non-stationary cointegrating series and has a super consistency property which arise from the reparameterization of the original regression equation. Together with previous work by Masih and Masih (1996), Agarwal (2001), Konno and Fukushige (2003), Narayan (2004) and Narayan and Narayan (2005), I rely on the DOLS to achieve my research goals due to the superiority it has over other regression estimation techniques, as discussed above.

¹ The DOLS estimator has several features in common with an earlier estimator proposed by Bewley (1979).

As the DOLS is most appropriate for non-stationary cointegrating series, I test for the presence or absence of unit roots in my series as well as testing for the presence or absence of a long-run relationship in the series. As is standard procedure in the literature I conducted post estimation diagnostic checks to ascertain if the results do not suffer from any violations of the ordinary least squares assumptions.

To achieve my second paramount objective of empirically providing evidence for the channels through which budget deficit is growth promoting, I control for a number of alternative government expenditure priorities that may lead to higher levels of economic growth in the subsequent years, to the original empirical regression model and observe the behaviour of the budget deficits economic growth relationship. To achieve this goal, I tried on a number of channels like manufacturing, agriculture, services, tourism and lastly, export of ores and metals as a percentage of merchandise exports as these can be possible channels through which budget deficits can be beneficial to economic growth. As for export of ores and metals as a percentage of merchandise exports (omexp), my justification in this regard is that South Africa is endowed with large amounts of ores and minerals. This is supported by the fact that South Africa is the highest world producer of gold and diamond. The key question therefore is whether it will not be growth beneficial if South Africa would dedicate its deficit spending to providing sustainable policies to make the exportation of ores and metals globally competitive. The variable, ores, and metals as a percentage of merchandise exports is sourced from the World Bank Development Indicators. However, the variable has missing values for the years 1985 to 1991. To fill in the missing values, I rely on the Hodrick-Prescott Filter data smoothing method.

To counteract the possible suspicion that the empirical results obtained in this article, as described above, maybe due to chance or a result of a mere combination of budget deficit and a set of control variables, I estimated another confirmatory empirical regression model

with a different combination of explanatory variables to ascertain if the results are confirmatory. In line with this goal, in addition to the set of explanatory variables described earlier, I introduced the age dependency ratio as a percentage of the working population. The variable, age dependency ratio was obtained from the WDI. Results for both the baseline empirical regression model and the confirmatory empirical regression model are discussed in the next section.

4: Results and Discussion

As I have discussed above, I conducted several pre-estimation inferences. Table 1 presents the descriptive statistics. It can be inferred that South Africa has been experiencing budget deficits over the period under review; the highest budget deficit to GDP ratio being 6.6 percent, an average of 3 percent of GDP whereas the lowest is 0.7 percent. Inference of the descriptive statistics was followed by the correlation matrix, as presented in Table 2. Though this is an informal inference of the relationship between GDP and each of the explanatory variables used in the empirical model but results overall show that the relationships conform to economic expectations. Budget deficit emerges to be positively related to economic growth, thereby, at this time discriminating in favour of the Keynesian perspective. One other important observation is that inflation is positively related to economic growth. This may appear surprising and contrary to economic expectations. It may not make sense how inflation could have a positive relationship with economic growth. Nonetheless, I enlist the explanation proffered by Barro (1995). He argued that inflation can be an engine of growth at low levels and may start to be detrimental to economic growth at high levels. This could make sense as inflation has been kept under control since South Africa has adopted inflation targeting as a monetary policy since the year 2000.

A conduct of unit root tests showed that the variables used in my empirical regression model were all first-difference stationary. As has been pointed out before, one pre-condition for using the DOLS is when the variables used in the empirical regression model are nonstationary. Having said this, I have met one condition to proceed to use the DOLS as my empirical estimation technique. The results of the test of the underlying data generating processes are reported in Table 3.

Since the variables in this article, as described above, all have a unit root, I follow standard economics procedure to infer if there is cointegration among the series (Engle and Granger, 1987). Existence of cointegration is the second precondition for one to rely on the DOLS as the preferred estimation technique. To achieve this sub goal, I relied on the Hansen Parameter Instability test developed by Hansen (1992) as well as Gregory and Hansen (1996) which remain super consistent in the event of structural breaks within cointegrating relationships. As has been pointed out earlier, the South African economy has gone through significant episodes, over the period under review, which make existence of structural breaks in the series highly likely. This includes the dawn of a new democratic government in 1994, the effect of the global financial crisis and several episodes of drought over the period under review. For confirmatory purposes I also relied on evidence from the Phillips-Ouliaris, though bearing in mind that the preferred cointegration test is the Hansen Parameter Instability test. Findings from both cointegration tests were confirmatory to the fact that there was cointegration among the series. These results are presented in Table 4.

Having accomplished these sub goals, I dedicate the next section to a presentation and discussion of the empirical estimation results, to provide an answer to my first goal, as articulated in an earlier section.

Dynamic Ordinary Least Squares Estimates

Table 5 presents the results from the estimation of my empirical model relying on the DOLS estimation technique. At this point, I can now give empirical evidence to answer my first objective. All the explanatory variables are highly statistically significant and conform to economic theory. This indicates that changes in budget deficit as well as the other control variables correlates with shifts in the gross domestic product per capita. As the independent variables are statistically significant, a high coefficient of determination makes sense, as is shown by a high coefficient of determination of approximately 98 percent. The coefficient of determination of approximately 98 percent shows that 98 percent of the variation in economic growth is explained in the model while only 2 percent is captured by the error term.

The explanatory variable of interest, budget deficit, is positively related to economic growth. This provides empirical evidence for me to conclude that our empirical results discriminate in favour of the Keynesian theory that budget deficit is growth stimulating.

Focussing on our first goal, one can safely conclude that, in the case of South Africa, the neoclassical school of thought that budget deficit is corrosive to long run economic growth is not supported by the data. Budget deficit is positively related to economic growth where a 10 percent increase in budget deficit is associated with a 0.2 percent rise in economic growth. This is just one of our objectives. As we have pointed out in the earlier sections, ascertaining the relationship between budget deficit and economic growth is one thing but further exploring the ways in which deficit spending is growth supporting is paramount to the relevant policy makers.

One conclusion that can be drawn from Table 5 is that budget deficit does not promote growth through gross fixed capital formation. The justification to this claim is that, by merely including gross fixed capital formation in the empirical regression model, I have controlled for

gross fixed capital formation, and yet budget deficit emerges positive and statistically significant.

As is standard in the literature, I conducted post estimation diagnostic checks to ascertain if my results do not suffer from any violations of the ordinary least squares. Figure 2 presents the normality test results and amply show that the residuals are normally distributed.

Pursuant with my second goal, I tried several channels. The results of this exercise which help me to give empirical response to the above goal are shown in Table 6.

To give empirical evidence on the channels through which budget deficits is beneficial to economic growth, I controlled for ores and metals exports as a percentage of merchandise exports (omexp), as fully explained in an earlier section. I present the results of this exercise in Table 6.

The results show that budget deficit maintains its positive relationship with subsequent economic growth but loses its statistical significance. This is true with other control variables in the empirical regression model. On the other hand, the variable capturing the possible channels, ores and metals exports as a percentage of merchandise exports (omexp), is positive and statistically significant at 1 percent. The implication of these results is that budget deficit is beneficial to long run economic growth if it is dedicated to export industrialisation of ores and metals. Discussion around export-led growth has been around for some time now (Adelman, 1984; Chow, 1987; Giles and Williams, 1999;). The authors argue that developing economies can enhance long run economic growth through the promotion of export strategies.

As has been pointed out in an earlier section, for one to believe the results that they truly reflect the relationship between budget deficit and economic growth as well as the channels through which deficit spending is growth promoting, I went on to run another empirical regression model with a new set of explanatory variables. In addition to the control

variables used in the baseline empirical regression model, I included age dependency ratio. The results are presented in Tables 7 and 8. All the pre-estimation inferences were made but are not presented here for reasons of brevity.

In Table 7, budget deficit maintains its positive relationship with economic growth and is statistically significant. This is true with other control variables used in the confirmatory empirical regression model. Age dependency ratio carries a negative sign and is statistically significant which is in support of economic theory. The higher the number of the young and the old in proportion to the working-class population the higher is the dependency. Income that could be channelled towards savings or investment purposes, which enhances economic growth, would be dedicated to supporting the young and the old.

Table 8 present the results of the channels through which deficit spending is growth favourable if one controls for export of ores and metals. The results conform to those from the baseline empirical regression estimation. Budget deficit maintains its positive relationship with economic growth but loses its statistical significance. At the same point, the variable, export of ores and metals is positively related and statistically significant. The conclusion that can be drawn is that the results obtained in the baseline empirical regression model are not due to chance but are a true reflection of the relationship in the data.

As relevant as this article is, but I hasten to point out that my results and policy implications, herewith, should not be taken to suggest that budget deficit is always positively related to economic growth even at substantial levels as a percentage of GDP. To conclude as such is dependent on further research focussing on ascertaining whether the relationship between budget deficit and economic growth in South Africa is nonlinear or not. If indeed it is nonlinear, it may be of great interest to ascertain the exact threshold at which budget deficit starts to be injurious to economic growth. It is my strong opinion that this information give

complete guidance to policy makers, as such empirical evidence would guide policy makers to depend on deficit spending sparingly, or not, as they approach a certain level. Consequently, I intent to focus on this research goal in the immediate future if no similar work is done before us.

5: Conclusion and Recommendations

This article gives an empirical evidence to two paramount questions with respect to the nexus between budget deficit and economic growth in South Africa. First, the article aimed to provide empirical evidence on the relationship between budget deficit and economic growth as there are two possible ways suggested in the literature. The second of this article is to ascertain the public expenditures for which deficit spending can be channelled to that lead to subsequent increases in economic growth. Relying on evidence from the DOLS estimator, this article provides evidence to vindicate the claim that budget deficit is beneficial to long run economic growth. Further to that the article also examined the channels through which budget deficit is growth promoting. In this regard, the empirical results provides evidence that budget deficit, in the case of South Africa, is favourable to economic growth if it is channelled towards export industrialisation of ores and metals. The possible implication to this finding could be that South Africa could be weakly integrated into global and regional value chains, that renders it to have limited opportunities to benefit from global growth. Export oriented industrialisation would make South African firms more competitive, transfer technology, join global supply networks, and overcome its historical isolation from the world economy.

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List of Tables and figures

Table I: Descriptive Statistics

| | GDP | BD | GFC | CPI |
|--------------|----------|-----------|----------|----------|
| Mean | 47934.72 | -3.048718 | 19.98138 | 62.24780 |
| Median | 46713.70 | -3.200000 | 19.22779 | 56.86289 |
| Maximum | 55514.43 | 0.700000 | 29.12272 | 152.6328 |
| Minimum | 40394.93 | -6.600000 | 15.15028 | 6.481211 |
| Std. Dev. | 5145.338 | 1.787805 | 3.812569 | 43.23606 |
| Skewness | 0.177326 | 0.270388 | 1.008229 | 0.473222 |
| Kurtosis | 1.580109 | 2.188567 | 3.264964 | 2.141362 |
| Jarque-Bera | 3.480534 | 1.545151 | 6.721504 | 2.653650 |
| Probability | 0.175474 | 0.461822 | 0.034709 | 0.265318 |
| Sum | 1869454. | -118.9000 | 779.2738 | 2427.664 |
| Sum Sq. Dev. | 1.01E+09 | 121.4574 | 552.3558 | 71035.57 |
| Observations | 39 | 39 | 39 | 39 |

Notes to Table I: Data is obtained from the World Bank's World Development Indicators as well as the South African Bank's Statistical Online Query for the period 1980 to 2018.

Table II: Correlation Matrix

| | GDP | BD | GFC | CPI |
|-----|----------|-----------|-----------|-----------|
| GDP | 1.000000 | 0.053837 | 0.308266 | 0.707883 |
| BD | 0.053837 | 1.000000 | 0.214156 | -0.197282 |
| GFC | 0.308266 | 0.214156 | 1.000000 | -0.391564 |
| CPI | 0.707883 | -0.197282 | -0.391564 | 1.000000 |

Notes to Table II: data are taken from the World Development Indicators as well as the South African Bank's Statistical online query. I only present the correlation matrix without worrying necessarily worrying about the statistical significance of the variables.

Table III: Results of Stationarity Tests

| Variable | | Phillips-Perron | Augmented Dickey-Fuller |
|----------|------------------|-----------------|-------------------------|
| Lgdp | Level | -0.594 | 0.789 |
| | First Difference | -3.866*** | -3.817*** |
| Bd | Level | -2.528 | -2.508 |
| | First Difference | -7.47*** | -5.798*** |
| Lcpi | Level | 5.983 | 3.263 |
| | First Difference | -3.415* | -3.634** |
| Gfc | Level | -2.094 | 5.983 |
| | First Difference | -4.037*** | -3.415* |

Note to III: ***, **, * reflect significance at 1%, 5% and 10% levels of significance, respectively. Data are taken from the World Bank's World Development Indicators and the South African Bank's Statistical Online Query.

Table IV: Results of Cointegration Tests

| Hansen Parameter Instability | | Phillips Ouliaris | | |
|------------------------------|-------------|-------------------|---------|-------------|
| Stochastic Trend | Probability | | Value | Probability |
| 3 | 0.2 | Tau-statistic | -3.465 | 0.250 |
| | | z-statistic | -18.192 | 0.248 |

Notes to Table IV: Data are from 1980 to 2018 and were sourced from the World Bank's World Development Indicators and the South African Bank's Statistical Online Query.

Table V: Dynamic Ordinary Least Squares Estimator Results

| Variable | Coefficient | t-statistic | Probability |
|--------------------|-------------|-------------------------------|-------------|
| BD (0.0044) | 0.0158 | 3.575 | 0.002 |
| Log (CPI) (0.0168) | 0.1784 | 10.5778 | 0.000 |
| GFC (0.0026) | 0.0384 | 14.850 | 0.000 |
| C (0.1061) | 9.3395 | 87.9568 | 0.000 |
| $R^2 = 0.978$ | | Mean dependent Variable=10.76 | |

Adjusted $R^2 = 0.960$

Sum squared Residual=0.0089

Notes to Table V: the dependent variable is Gross Domestic Product per capita (*lgdp*) Figures in parenthesis signify standard errors. Data are from 1980 to 2018 and were collected from the WDI and the South African Reserve Bank’s Statistical Online Query. Figures in parenthesis signify standard errors.

Figure 2: Normality Test Results

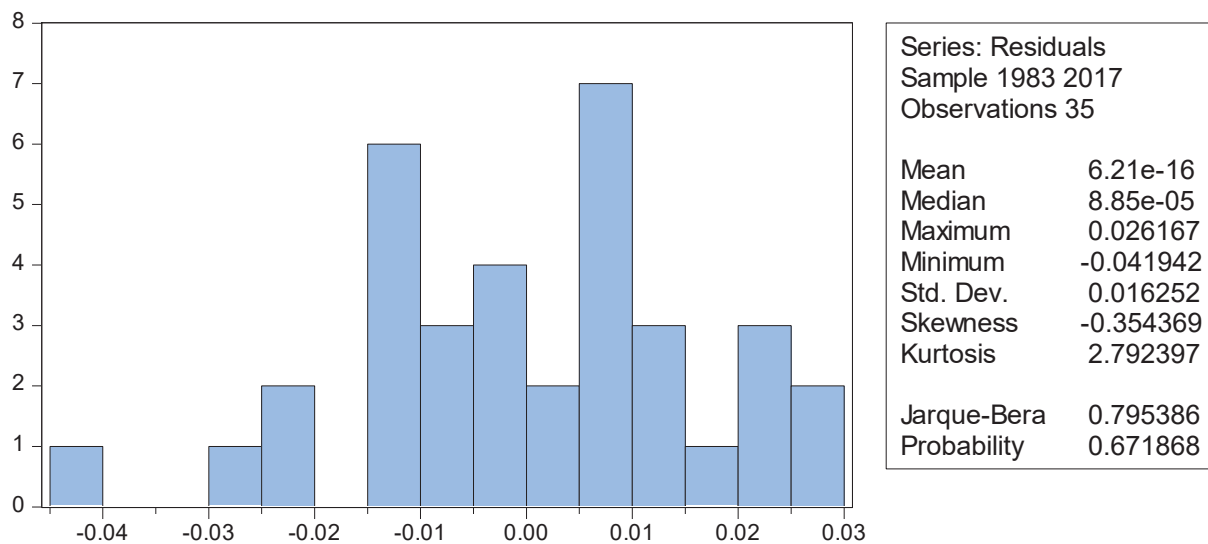


Table VI: Budget Deficit-Economic Growth Channels in South Africa (1980-2018)

log GDP is the dependent variable

| Variable | Coefficient | t-statistic | Probability |
|-------------------|-------------|----------------------------|-------------|
| BD (0.0046) | 0.0065 | 1.4175 | 0.19 |
| Log (CPI) (0.027) | 0.0212 | 0.782 | 0.454 |
| HPTOMEXP (0.0034) | 0.0124 | 3.657 | 0.005 |
| GFC (0.0054) | 0.0094 | 1.747 | 0.115 |
| C | 10.227 | 72.933 | 0.000 |
| $R^2 = 0.99$ | | S. E of regression = 0.007 | |

*Adjusted R*² = 0.99

Mean dependent variable = 10.765

Sum squared residual = 0.00044

Note: Figures in parenthesis signify standard errors. Data are from 1980 to 2018 and were sourced from the WDI and the South African Reserve Bank's Statistical Online Query.

Table VII: Confirmatory DOLS Regression Results

The dependent variable is log GDP per capita

| Variable | Coefficient | t-statistic | Prob |
|-------------------------------|-------------|-------------------------------|--------|
| BD (0.0026) | 0.0054 | 2.0711 | 0.052 |
| log (CPI) (0.0252) | 0.0308 | 1.222 | 0.236 |
| DEP (0.0021) | -0.0041 | 1.9378 | 0.0677 |
| GFC (0.0031) | 0.0072 | 2.3124 | 0.0321 |
| C (0.24914) | 10.8731 | 43.6425 | 0.0000 |
| $R^2=0.99$ | | Mean dependent var=10.765 | |
| <i>Adjusted R²</i> | | S.D dependent var = 0.1085 | |
| S.E of regression=0.011 | | Sum squared residual = 0.0024 | |

Notes to Table VII: the dependent variable is Gross Domestic Product per capita (*lgdp*) Figures in parenthesis signify standard errors. Data are from 1980 to 2018 and were collected from the WDI and the South African Reserve Bank's Statistical Online Query. Figures in parenthesis signify standard errors.

Table VIII: Confirmatory Budget Deficit-Economic Growth Channels

Log of GDP is the dependent variable

| Variable | Coefficient | t-statistic | Prob |
|--------------------------------------|-------------|--------------------------------|--------|
| BD (0.00457) | 0.000144 | 0.0315 | 0.9753 |
| Log (CPI) (0.0325) | 0.04650 | 1.4273 | 0.1740 |
| DEP (0.00614) | 0.01073 | 1.74788 | 0.1009 |
| GFC (0.0030) | 0.01030 | 3.41044 | 0.0019 |
| HPTOMEXP (0.0050) | 0.01899 | 3.7686 | 0.0019 |
| C (0.5436) | 9.4493 | 17.3812 | 0.0000 |
| $R^2=0.99$ | | Mean dependent var = 10.766 | |
| <i>Adjusted R² = 0.99</i> | | S.D. dependent var = 0.1085 | |
| S.E of regression=0.0105 | | Sum squared residual = 0.00166 | |

Notes to Table VIII: the dependent variable is Gross Domestic Product per capita (*lgdp*) Figures in parenthesis signify standard errors. Data are from 1980 to 2018 and were collected from the WDI and the South African Reserve Bank's Statistical Online Query. Figures in parenthesis signify standard errors.