Applying the National Income Identity Approach in Examining Determinants of Economic Growth in South Africa

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Abstract
From the mid-1990s to mid-2000s, the economic performance of the South African economy was relatively good but lower than growth of comparable economies. This is attributed to different factors such as low savings, low investment levels as well as the structure of the South African economy. The paper applies the macroeconomic identity to explore the impact of the key drivers of the South African economy, using the Autoregressive Distributed Lag (ARDL) econometric approach and data from 1980 to 2019. To test for the long-run relationship we used the co-integration test and the Vector Error Correction Model (VEC). The main results are that consumption, investment, and exports are key economic growth determinants in South Africa. This holds regardless of the time horizon. To confirm the long-run relationship we further performed the robust bound tests and the results indicate that there is a long-run relationship among the variables. From a policy perspective, it would be recommended that government ensures that there is higher investment in the economy and that exports are increased. In addition, based on the results, it is important to not only focus on the national income identity variables but also other factors that can negatively affect economic growth.

Keywords: Consumption; Investment; Government Spending; Exports; Growth.
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1. Introduction

There are many questions about the performance of the South African economy. Many attribute the poor performance of the South African economy to its structure; it is the structure of the South African economy that limits its growth. Some studies attribute the poor performance of the South African economy to low savings and low investments. From the perspective of Bacha's three-gap model, foreign exchange can be another binding constraint as work undertaken by Gumede (2000) implied. We take it for granted that savings, investments, and foreign exchange are the key binding constraints to the South African economy. There is also work that confirms that skills are a constraint, or rather skills mismatch limit economic growth in South Africa. High levels of economic inequality, unemployment, and poverty also constrain the growth of the South African economy. Lack of clear policies, especially economic and social policies, is another limiting factor to the growth of the South African economy.

Given the emphasis that has been put on the restructuring of the South African economy or the structural transformation of the South African economy, we set out to understand the relationship between economic growth and the components of aggregate demand. There has not been recent work on this focusing on South Africa. It is critical that there is an understanding of key determinants of economic growth, both in the short and the long run. 2019 is the last year included in the data for this paper because the coronavirus pandemic reached South Africa early in year 2020 which is a shock in the data that can bias the analysis if we include 2020 and 2021.

Although there is a fair number of studies that have investigated the impact of different macroeconomic factors on growth, there is no consensus on the key drivers of economic growth. This might be due to different techniques and data used in different studies. Mo (2007); Goldsmith (2008); Mabugu, *et al*. (2013); Jooste *et al*. (2013); Kneller and Misch (2014); Kavese and Erero (2018) investigated the impact of government spending on economic growth, and found that government expenditure is positively correlated with economic growth. Romero and Strauch (2003) and Schaltegger and Torgler (2006) concluded that the size of government spending was detrimental to economic growth. Ghani and Din (2006) find that only public investment has a positive correlation with economic growth, while Day and Yang (2011) argue that this will only yield the expected results depending on the marginal propensity to consume along with the marginal propensity to save which will thereafter increase investment. Along the same lines, (Qin, *et al*. 2006; Villa 2008 and Roman & Padureanu 2012) investigated the relationship between growth and investment and found a long-run relationship between the two variables. Radulescu *et al*., (2019); Pegkas (2018); Wang and Wen (2017) analyzed the extent to which consumption plays a role in economic growth. The results point to a positive relationship between consumption and economic growth. This implies that, *ceteris paribus*, consumption drives economic growth. This is not surprising because about 60% of almost all the economies worldwide are driven by private consumption.

The South African economy has not performed well. Granted, before democracy or at the dawn of democracy the South African economy was in a recession. The first few years of the democratic dispensation went into macroeconomic stabilization. The economy started growing from the late 1990s but it was affected by the Asian economic crisis. The South African economy grew relatively rapidly during the 2000s but it started to deteriorate from 2008/9, partly due to the global financial crisis. It should be noted that even when the South African economy was growing rapidly, its growth rates were below those of comparable countries. It is therefore important to understand which factors, from a macro perspective, matters more in the performance of the South African economy.

We apply the ARDL econometric approach using data for the 1980-2019 period to investigate the impact of the components of the aggregate demand on economic growth. We deliberately start during the apartheid period and end before the full effects of the coronavirus are felt. Results indicate that consumption, investment, and exports are key economic growth determinants in South Africa. Therefore, this implies that government should focus more on public investment than public consumption and create a suitable business environment to allow different economic agents to actively participate in the economic activities and thereafter increase consumption and export. Given that there are no recent studies regarding the national income identity in the South African context, the paper makes an important contribution to empirical and theoretical literature in a developing country context. For South Africa, the paper also contributes to literature pertaining to public policies because we recommend that the government should endeavor to maintain higher investment levels in the economy and improve the external sector.

The remainder of this paper is organized as follows. Section 2 houses the literature review on the link between economic growth and the components of GDP. The methodology and estimation techniques are disscussed in Section 3. Section 4 discusses the presentation and discussion of empirical estimations, while section 5 presents the summary of findings, concluding thoughts and policy implications.

2. Theoretical and empirical perspectives

As originally presented by Serrano (1996) and later developed in Freitas and Serrano (2015), an alternative theoretical approach shows that the components of demand such as consumption (C), investment (I), government spending (G) as well as the net exports (X-M) play a significant role in determining economic growth. Although these components are significant for economic growth, it is important to test their empirical significance. While some studies have focused more on the impact of the consumption variable mainly (see for example Mo 2007; Goldsmith 2008; Qazizada and Stockhammer 2015), some studies have taken one step further by adding other components of the aggregate demand as control variables (Qin *et al*. 2006; Ghani and Din 2006; Tsen 2008; Day and Yang 2011; Wang and Wen 2017; Pegkas 2018; Radulescu *et al*. 2019 and Hsu *et al*. 2019). Furthermore, more recently, some scholars have devoted some endeavors to empirically test the Sraffian super-multiplier or simply the national income identity (see for instance Girardi & Pariboni 2016).

Among those who studied each variable, Mo (2007) for instance investigated the impact of government spending on economic growth and found that government spending is positively correlated with economic growth. This differs from earlier results by Romero and Strauch (2003) and Schaltegger and Benno (2006) that found that there was a negative correlation between government spending and economic growth. Romero and Strauch (2003) used a distributed lag model to investigate whether or not the persistent trend between growth and fiscal policy has been observed and found that government spending negatively affected economic growth. Schaltegger and Benno (2006) used a vast data set of rich countries to empirically test the relationship between growth and government size, and their findings show that in rich countries the size of government spending reduces the economic growth. Goldsmith (2008) finds that in the short-run an increase in public consumption and public investment is associated with an increase in economic growth. However, in the long run, the increases in public consumption and public investment will increase the interest rate and therefore crowd out the private investment, hence triggering a decrease in economic growth. Along the same lines, Qazizada and Stockhammer (2015) used TSLS estimation for panel data of 21 countries

to investigate the government spending multiplier in contraction and expansion and they find that during the expansion the government spending multiplier was about 1 against 3 during contraction. This makes a case for a countercyclical macroeconomic policy.

On the other hand, Ghani and Din (2006) used the VAR model to investigate the impact of public investment on economic growth in Pakistan and their results show that economic growth is mostly driven by private investment relative to public investment. Furthermore, Qin, et al. (2006) analyzed the empirical impact of investment on economic growth in China by employing the impulse response and concluded that there is a long-run positive correlation between investment and economic growth. This result was later confirmed by Villa (2008) and Roman and Padureanu (2012). However, this is not linear. For example, the impact triggered by this component is not regular either in the short or in the long run. In Villa (2008) and Roman and Padureanu (2012), output drives the investment demand in certain times.

Tsen (2008) used the granger causality and J cointegration techniques to examine the role of exports and domestic demand (total consumption, government spending, and investment) on GDP in Malaysia and concluded that export, domestic demand, and real GDP per capita had weak granger causality. However, different from consumption expenditure, government spending as well as investment, both granger cause with real GDP per capita. This implies that only these two components of aggregate demand seem to play a significant role in economic growth. However, due to the strong linear relationship between export and real GDP per capita, this is equally important to the real GDP per capita. Furthermore, Akalpler (2017) also analyzed the impact of net export on growth employing the VEC model and found that net exports are highly significant on the economic growth performance.

Day and Yang (2011) on the other hand conclude that the impact of an increase in government spending depends on the magnitude of marginal propensity to consume and to invest. Unlike, Wang and Wen (2017), employing the Monte Carlo analyses investigates the macroeconomic effects of government spending in China, concluded that there is a granger causality between government spending, consumption, and investment and economic growth. Pegkas (2018) employed the ARDL method to analyze the relationship between economic growth and a range of variables such as investment, consumption, government spending, trade openness, population growth, and government debt in Greece and found that although there is a long-run relationship between the variables, only investment, government spending, and trade openness affected growth positively. More recently, (Radulescu *et al*. 2019 and Hsu *et al*. 2019) used different econometric approaches to investigate different GDP responses to different economic shocks. For example, Radulescu et al. (2019) employed the panel least squares and the pool least-squares methods to investigate whether the high economic growth in Central Eastern European countries was driven by consumption or investment, as their results exhibit, growth is positively affected by consumption in the long run. Furthermore, Hsu et al. (2019) used the dynamic stochastic general equilibrium model and studied the economic fluctuations in China, and their results aligned with the earlier studies. For instance, they found that economic fluctuations in China are driven by government spending.

Unlike the previous studies, Girardi and Pariboni (2016) narrowed their study to evaluating empirically the Sraffian super multiplier. This was done by employing a co-integration technique and the US macroeconomic data and concluded that all the demand components and output are cointegrated and they play a significant role in output in the long run.

The stylized facts gathered in South Africa also exhibit similar inconclusive results regarding the impact of government spending on growth. Some scholars (Mabugu *et al*. 2013; Jooste *et al*. 2013; Kneller & Misch 2014; Kavese & Erero 2018 and Makrelov *et al*. 2018) find a positive impact of government spending on economic growth. Mabugu, *et al*. (2013) employed an inter-temporal Computable General Equilibrium (CGE) model and investigated the impact of fiscal policy in South Africa and their findings suggest a positive impact of the expansion in the fiscal policy on growth. Jooste et al. (2013) used a Dynamic Stochastic General Equilibrium (DSGE) model, a structural vector error correction model, and a time-varying parameter vector autoregressive model. The study found that although the countercyclical fiscal policy has been effective in South Africa, its impact differs according to the time. Kavese and Erero (2018) used Social Accounting Matrix (SAM-Leontief Model) to analyze the impact of fiscal expansion in the Eastern Cape province of South Africa. The results suggest that one rand (R1) rise in government expenditure is associated with an increase in economic growth, poverty reduction, and employment creation. Kneller and Misch (2014) investigated the same impact of the government spending, yet they disaggregate the data to firm-level and conclude that firm productivity is positively affected by expansionary fiscal policy (see also Makrelov, et al. 2018).

It is clear that although there are some efforts in looking at the impact of the fiscal policy on growth, there is a shortage of empirical studies in the South African literature looking at the impact of other components of the aggregate demand on economic growth, both separately and combined. Contrary to the previous studies in South Africa, we use the national income identity equation and analyze how C, I, G, and NX affect economic growth. The investment variable used is the gross fixed capital formation and the consumption variable is final consumption expenditure while government spending includes all government expenditures and compensation of employees as well as most expenditures on national defence and security but excludes government military expenditures that are part of government capital formation.

3. Methodology

3.1 Data

The focus of the paper is an investigation of the key drivers of the economic growth in South Africa using the macroeconomic national identity. To check if the results are sensitive to any kind of specification, we also included in the model some other factors that are more likely to influence economic growth. To do so, we use data from 1980 to 2019 collected from the World Development Indicators. In this study, we control for different variables such as consumption measured in 2010 constant prices, government spending measured as the general government final consumption (2010 constant prices), investment measured by the gross fixed capital formation, exports of goods and services (2010 constant prices), imports of goods and services (2010 constant prices) and later included inflation measured by the consumer price index, foreign direct investment, net inflow (%GDP) and social infrastructure proxied by the mobile phone subscribers per 100.

3.2 Model specification

In a situation where variables exhibit a mixed stationarity process, for instance, some at I(0) and some at I(1), the applicable and recommended method for the data analysis is the Auto-regressive Distributed lag (ARDL) model, this model can also be applied if all the variable are co-integrated of order I(1) and regardless of the sample size (Khan, et al. 2015 and Kan 2016). Therefore, considering that the ADF results indicate that some variables are stationary at the order I(0) while some are at the order I(1), we analyze the data by the ARDL model. The baseline output equation is defined as follows:

$$Y_t \equiv C_t + I_t + G_t + (X_t - M_t), \quad (1)$$

Where,

$$C_t = C_{0t} + cY_{dt}, \quad (2)$$

$$M_t = mY_t, \quad (3)$$

Equation (1) is the national identity equation therefore we use ≡ instead of the normal equality sign with Y denoting the level of output. On the right hand of the equation, the components of GDP, such as consumption (C) given by the sum of the autonomous (C_{0t}) and induced consumptions (cY_{dt}) (see equation 2 above), investment (I), government spending (G), and the trade balance or simply the net export (X-M). For simplicity, we assume a linear import and let m denote the marginal propensity to import (see equation 3). Assuming that the autoregressive distributed lag is a model of order p and n, ARDL (p, n), we define the model of a scalar variable y_t as follows:

$$Y_t = \sum_{i=i}^{p} a_i Y_{t-i} + \sum_{i=0}^{n} c'_i X_{t-i} + u_t, \quad (4)$$

Where
Y_t denotes the same as equation (1), X_t is the vector of autonomous components of the aggregate demand in time t , u_t is the error term. It is worth noting that equation (4) is included the constants, however, we suppress it for simplicity. The coefficients $a_i \; and \; c'_i$ are scalars and row vectors, respectively. We define the lag polynomial $a(L)$ and $c(L)$ by employing the lag operator L applied to each vector's component, $L^k X_t = X_{t-k}$, formally expressed as follows:

$$a(L) = 1 - a_1 L - \cdots - a_1 L^p,$$
$$c(L) = c_0 + c_1 L + \cdots + c_n L^n.$$

From the expressions above, equation (4) can be re-written as shown below:

$$a(L)Y_t = c'(L)X_t + u_t.$$

Although equation (4) can be easily estimated, to obtain parameters that can be economically interpretable, equation (4) must be transformed such that the $a^{-1}(L)$ gives an infinite distributed lag representation (for more details see Hassler & Wolters 2005). Along those lines, after some mathematical transformations by re-arranging the X's one obtains with Δ=1-L, see equation (5) below.

$$Y_t = \sum_{i=i}^{p} a_i Y_{t-i} + a(1)\beta' X_t - \sum_{i=0}^{n-1} (\sum_{j=i+1}^{n} c_j)' \, \Delta X_{t-i} + u_t, \quad (5)$$

Where
As previously suggested by Pesaran and Shin (1998), model (5) is suitable for cointegration analysis with Y_t being a function of its lag values, current X_t and differences ΔX_{t-i}. To take into account further specification Y_t to X_t and their differences we subtract $(\sum_{i=i}^{p} a_i) Y_t$. We further re-organize equation (5) and re-write it as exhibited below:

$$Y_t = \frac{-1}{a(1)} \sum_{i=0}^{p-1} (\sum_{j=i+1}^{p} a_j) \, \Delta Y_{t-i} + \beta' X_t - \frac{1}{a(1)} \sum_{i=0}^{n-1} (\sum_{j=i+1}^{n} c_j)' \, \Delta X_{t-i} + u_t, \quad (6)$$

Although equation (6) above is appealing because β's are the long-run coefficients of X_t, it also presents a shortcoming rising from the correlation between ΔY_t on the right-hand of the equation and the error term u_t, which in turn invalidates the OLS estimations (Bewley 1979 and Hassler & Wolters 2005). To overcome this, one has to go for further transformation that will allow for cointegration estimation and testing. This can be done by allowing $Y_{t-1}, \dots, Y_{t-p-1}$ and $X_t, \dots, X_{t-n+1}$ to be consistent instruments in the IV estimation.

For the sake of demonstration, we allow:

$$\sum_{i=1}^{p} a_i Y_{t-i} - Y_{t-1} = -a_i(1)Y_{t-1} - \sum_{i=1}^{p-1}(\sum_{j=i+1}^{p} a_j)\,\Delta\, Y_{t-i}.$$

Combining the equation above and the $X_t = X_{t-1} + X_t$ we get the error-correction model. This show the adjustment speed of Y_t through $a_i(1)$ to equilibrium deviations in the lagged period, $Y_{t-1} - \beta' X_{t-1}$, and is formally presented as shown below:

$$\Delta Y_t = \sigma Y_{t-1} + \delta' X_{t-1} + \sum_{i=1}^{p-1} a_i \Delta Y_{t-i} + \sum_{i=0}^{n-1} \pi'_i \Delta X_{t-i} + u_t, \quad (7)$$

Where,

$$\sigma = -\alpha(1), \delta = \alpha(1)\beta = -\sigma\beta, \quad (8)$$

The parameters a_i and π_i can be easily estimated. To check for the sensitivity of the results we perform a robustness check by adding some variables into the specification. Therefore, in that particular model, we allow the vector X_t to contain also consumer price index (CPI), foreign direct investment (FDI), and infrastructures**.**

4. Results and Discussion

4.1 Descriptive Statistics

Table 1 provides descriptive statistics of the logaritim variables used in the study. Emphasizing on the variables of interest, GDP, C, I, G, X and M, the table indicates that GDP has an average value of 21.9235 with minimum and maximum values of 19.0299 and 23.5435, respectively. Along the same lines, consumption appeas to have mean value of 21.4416 while the minimum and maimum values are 19.4415 and 23.2857. Furthermore, while investment exhibited an average of 21.2687, government spending exhibited an average value of 20.9251. Their minimum values ranged from 19.4620 to 22.6620 and 18.7841 to 22.7879 for investment and government spending, respectively. Finally, export and imports range from 25.0758 to 24.8408, with minimum and maximum values ranging from 24.4683 to 24.0365 and 22.5675 to 25.6084, respectively. As can be noted, non of the variables seems to be an outlayer, therefore we can proceed with the estimations.

Table 1: Summary statistics

Variable	Acronym	Mean	Std.Dev	Min	Max
Gross domestic product	LogGDP	21.9235	.9904	19.0299	23.5435
Consumption	LogCons	21.4416	1.0151	19.4415	23.2857
Government spending	LogGov	20.9251	1.1433	18.7841	22.7879
Investment	LogInv	21.2687	.8891	19.4620	22.6620
Export	LogX	25.0758	.3867	24.4683	22.5675
Import	LogM	24.8408	.5569	24.0365	25.6084
Consumer Price Index	CPI	64.6648	45.3332	6.4812	158.9279
Foreign Direct Investment	FDI	.9295	1.2361	-.7661	5.9831
Infrastructure	----	50.6781	61.0451	0	165.5999

In most cases, time-series data are more likely to suffer from unit root problems (Kan, 2016). Therefore, before data and regression analysis it is important to check the integration order among the variables. One of the fundamental conditions in the time series data is the mixed co-integration order I(0) and I(1) of the data (Ouattara, 2004). However, these should not be co-integrated of order I(2), if so, neither F-stats results nor any prominent regression method is applicable. Therefore, to avoid spurious regression we have used the Augmented Dickey-fuller (ADF) test to check the existence of the unit root and the co-integration order in our data. To check whether the ADF test must include a trend or constant we first regressed each variable on its constant and trend and the results as shown in Table 2 point out to the need for the inclusion of constant and trend in all the variables except FDI that the constant is not statistically significant.

Table 2: Variable diagnosis

Variable	Constant	Trend
logGDP	25.902***	.024***
logCons	25.507***	.029***
logGov	24.217***	.026***
LogInv	23.972***	.031***
logX	24.447***	.032***
logM	23.945***	.046***
logCPI	2.326***	.077***
FDI	-.009	.048**
Infrastructre	-42.610***	4.784***

4.2 Unit Root Results

After determining whether to include or not constant and trend, we take a step further and compute ADF test and the results are summarized in Table 3. The results show that only FDI is integrated of order I(0) exhibiting no existence of unit root, and all other variables are co-integrated of order I(1). In other words, they become stationary at the first difference and none of the is co-integrated of order I(2), meeting in this case the fundamental condition of the Autoregressive Distributed Lag (ARDL) approach.

Table 3: Unit Root Test Results (Augmented Dickey-Fuller)

	ADF Prob (level)	Decision	ADF Prob (First difference)	Decision	Cointegration
GDP	.3603	Not stationary	.0203**	Stationary	R(I)
Cons	.5134	Not stationary	.0325**	Stationary	R(I)
Gov	.3811	Not stationary	.0209**	Stationary	R(I)
Inv	.2754	Not stationary	.0228**	Stationary	R(I)
X	.1564	Not stationary	.0001**	Stationary	R(I)
M	.3236	Not stationary	.0004**	Stationary	R(I)
CPI	.9987	Not stationary	.0359**	Stationary	R(I)
FDI	.0003**	Stationary	----------	----------	R(0)
Infrastructure	.7801	Not stationary	.0001**	Stationary	R(I)

Critical Value of ADF is selected at 5% significance level. (*****) & (******) shows rejection of Null Hypothesis at 5% & 10%.

4.3 ARDL Results

The impact and influence of the determinants of growth in the national income identity (C, I, G, and NX) are empirically regressed employing the ARDL approach as an analytical technique and the main results are summarized in Table 4 below. The model relevance is tested through R-squared and adjusted R-squared while the significance of the coefficients is tested from t-stats and Prob. Values. The lag-length and lag specification criterion for the model is selected from Akaike information (AIC) and Schwarz information (SIC) criteria. Table 4 indicating results confirm that the variables we analalyzed play a significant role in the national identity. However, their level of growth determination varies. For example, apart from the GDP of the previous period, capturing initial conditions, consumption is found to be a major determinant of economic growth in South Africa, exhibiting that a 1% increase in consumption increases economic growth by 60%. The result confirms what was previously found by (Qin, et al. 2006; Villa 2008 and Roman & Padureanu, 2012). This also aligns with the impact of consumption on economic growth in several economies where about 70% of growth in those economies is also driven by private consumption. This implies that if the government aims to increase economic growth, one must ensure that different households actively participate in the economy such that their income level increases so that their consumption expenditure responds accordingly. This makes a case for the various interventions that the South African government pursues in trying to ensure economic activity by households and individuals.

Table 4: ARDL Regression results

	Model I		Model II	
Variable	Coef.	Std.Err	Coef.	Std.Err
Log(GDP(-1))	.696**	.1551	.762**	.0589
Log(Cons)	.598**	.1810	-.122	.0672
Log(Cons(-1))	-.536**	.2051	.948**	.1135
Log(Cons(-2))	.136	.2187	-.934**	.1032
Log(Cons(-3))	.108	.0867	1.811**	.1201
Log(Gov)	-.032	.1089	.404**	.0485
Log(Gov(-1))	-.172**	.0927	-.528**	.0274
Log(Gov(-2))	.104	.0804	.102**	.0316
Log(Inv)	.131**	.0412	-.367**	.0365
Log(Inv(-1))			.197**	.0324
Log(Inv(-2))			-.748**	.0400
Log(Inv(-3))			.060**	.0098
Log(X)	.010**	.0413	.043**	.0160
Log(X(-1))	.052	.0422	-.246**	.0210
Log(X(-2))	.030	.0370	.182**	.0148
Log(X(-3))	-.059**	.0281	.105**	.0142
Log(M)	-.000	.0483	.269**	.0173
Log(M(-1))	-.101**	.033	-.043**	.0128
Log(M(-2))	-.051	.0326	.320**	.0224
Log(CPI)			-.212**	.0651
Log(CPI(-1))			-.238**	.0438
Log(CPI(-2))			-.730**	.0669
Log(CPI(-3))			.681**	.0580
FDI			-.004**	.0004
FDI(-1)			.002**	.0005
FDI(-2)			.002**	.0006
FDI(-3)			.004**	.0001
Infrastructure			.000**	.0001
Infrastructure(-1)			-.002**	.0001
Infrastructure(-2)			.001**	8.79
Infrastructure(-3)			-001**	.0001
AIC		-6.8451		-11.4298
SC		-6.1485		-9.9495
HQC		-6.5996		-10.9080
R-Squared		.9996		.9999
Adj. R-Squared		.9994		.9999

(*) and (**) showing significance at 1% & 5% respectively.

Investment is also found to be stimulating economic growth in South Africa, just like Ghani and Din (2006) found and this is in line with economic theory. Our results suggest that investment is positively correlated with economic growth and the relationship is statistically significant. However, its magnitude is smaller relative to that of consumption. For example, while consumption constitutes 60% of the overall economy, investment increases economic growth by 13% when it increases by 1%. As previously considered as a growth engine by several scholars and policymakers, export also plays a significant role both empirical and theoretically in boosting economic growth.

The results in Table 4 show the coefficient value of (.010) which implies that a one percent increase in export will lead to a 1% increase in economic growth. Although statistically significant, its magnitude is small compared to the consumption magnitude impact on growth.

This again shows that consumption is found to be trumping almost all other factors in the national income identity. While consumption, investment, and export exhibit a significant impact on boosting economic growth, other variables in the national income identity are found not to be playing a significant role. Kavese & Erero (2018) and Makrelov, et al. (2018), provide a possible explanation for weak correlation between government spending and growth that different shocks that forced the government to increase its expenditures increase the debt burden. For instance, apart from presenting a very small coefficient of 3%, government spending is even detrimental to economic growth. In order words, if this was significant it would imply that in the short run, a one percent increase in government spending decreases economic growth by 3%.

Considering that GDP can also be determined by some other factors different from those controlled for in the national income identity, we also included other regressors in the analysis. We include inflation, FDI, social infrastructures (measured by the mobile phone subscribers per 100 in our case). As model II in Table 4 shows, these variables also plays a role. For example, it is notable that although consumption is statistically insignificant, it is detrimental to growth. This implies that the impact of consumption or any other factor in the national income identity is sensitive to the model specification. Another interesting thing to note is that investment also has become negative, and it is statistically significant. The inclusion of the variables in model II also had an impact on the export coefficient. Although this has remained statistically significant, its magnitude increased showing that not controlling for those factors can obscure the real picture of the impact of exports on economic growth. Furthermore, all the variables included in model II seem to be having a significant impact on growth as they are all statistically significant which is in line with economic theory and empirical literature. Attention should be paid to the social infrastructure, where although positive and statistically significant, its magnitude is small suggesting that it does not have a major impact on growth. This might be due to the measurement we have used. This is a tricky variable as it depends on availability of data.

We employed an ARDL error correction model for long-run relationships. The results are summarized in Table 5.

Table 5: ARDL-ECM

	Model I		**Model II**	
Varibable	Coef.	Std.Err	Coef.	Std.Err
Dlog(Cons)	.596***	.0911	-.122**	.0177
Dlog(Cons(-1))	-.244**	.1202	-.867***	.0241
Dlog(Cons(-2))	-.108	.0711	-1.811***	.0386
Dlog(Inv)			-.367***	.0083
Dlog(Inv(-1))			.687**	.0120
Dlog(Inv(-2))			-.060**	.0027
Dlog(Gov)	-.033	.0598	.404***	.0081
Dlog(Gov(-1))	-.105**	.0534	.063**	.0064
Dlog(Gov(-2))			.165**	.0073
Dlog(X)	.010**	.0285	.043**	.0042
Dlog(X(-1))	.028	.0262	-.287***	.0074
Dlog(X(-2))	.059	.0214	-.105**	.0051
Dlog(M)	-.001	.0217	.269***	.0049
Dlog(M(-1))	.051**	.0198	-.302***	.0053
Dlog(M(-2))			.018**	.0027
Dlog(CPI)			-.212**	.0102
Dlog(CPI(-1))			.049**	.0122
Dlog(CPI(-2))			-.681***	.0151
D(FDI)			-.004***	.0001
D(FDI(-1))			-.006***	.0001
D(FDI(-2))			-.004***	.0001
D(INFR)			.000**	2.26
D(INFR(-1))			-.000**	2.23
D(INFR(-2))			-.001**	2.22
CointEq(-1)*	-.3037***	.0499	-.2377***	.0042
AIC		-7.1154		-11.9163
SC		-6.6365		-9.9495
HQC		-6.9467		-10.8279
R-squared		.9381		.9997
Adj. R-Squared		.9142		.9993

(*****) shows co-integrating variables

The ARDL co-integration test results suggest that while some variables are strongly co-integrating with each other basd on their levels of significance some are not. For example, it should be noted that among all other variables, as indicated by the co-integrating results in Table 4, there is significant co-integration between consumption and export but there is no long-run relationship between growth and government spending, investment, and imports in South Africa. This implies that in the long run only consumption and export can be relied on to increase economic growth in South Africa. Furthermore, when adding other variables in model II we found a significant long-run relationship among all variables.

4.4 Bound Test

After analyzing the co-integration of the long-run relationship between economic growth and its determinants we employ the ARDL bound test approach. The null hypothesis of the bound test is that there is no relationship among the variables in the long run, while the alternative hypothesis indicates otherwise. Tables 6 and 7 summarize the results showing that the null hypothesis of the non-existence of the long-run relationship is rejected when the critical value is higher than the lower I(0) and the upper I(I) bounds. In Table 6 we test the existence of the long-run relationship in the overall model I and II and the critical values of the overall test are

4.9799 and 81.1816. These are greater than the lower bound of 2.14 and upper bound of 3.34 at a 5% level of significance and 2.11 and 3.15 for the lower and upper bounds, respectively. This means that we reject the null hypothesis of the non-existence of the long-run relationship among the variables. Therefore, there is an overall long-run relationship among the variables of the study.

Table 6: Results of the bound test

F-Bounds Test Null Hypothesis: No Levels relationship

Test Statistic	Value		Significance level	I(0)		I(1)	
F-Statistic	4.9799	81.1816	10%	1.81	1.85	2.93	2.85
K	5	8	5%	2.14	2.11	3.34	3.15
			2.5%	2.44	2.33	3.71	3.42
			1%	2.82	2.62	4.21	3.77

Critical Value is selected at a 5% significance level.

To confirm this relationship, we have also tested for each variable and the result is consistent with the overall results. For example, in Table 7 we also found that the negative critical value selected at a 5% level of significance is also greater than the negative values of the lower bound of (1.95) and the upper bound of (3.83). This shows that there is a long relationship between the variables and economic growth.

Table 7: Results of the bound test

t-Bounds Test Null Hypothesis: No Levels relationship

Test Statistic	Value	Significance level	I(0)	I(1)
t-Statistic	-6.0823	10%	-1.62	-3.49
		5%	-1.95	-3.83
		2.5%	-2.24	-4.12
		1%	-2.58	-4.44

Critical Value is selected at a 5% significance level.

5. Conclusion

The relationship between the components of aggregate demand has been analyzed by many scholars and in many instances the results are inconclusive. Given the poor performance of the South African economy, we attempt to investigate the impact of different components of the aggregate demand on economic growth in South Africa using the ARDL econometric approach and 40 years South African time series. We find that consumption, investment, and export are indeed key economic growth determinants in South Africa. This relationship holds regardless of the time horizon. For example, the co-integration test confirms that the said variables play a significant role in in boosting economic growth in the long run. Although the literature has been arguing that government spending is positively correlated with economic growth, we found that the size of government spending matters.

To check if the results are sensitive to any model specification we also included other critical variables such as inflation, foreign direct investment as well as social infrastructure. It would seem that ignoring some of these factors may result in over or underestimating the impact of some of the factors within the macroeconomic national income identity. For instance, we find that after controlling for the mentioned factors, the impact of consumption changes to negative

while export increased its magnitude towards economic growth. We also find a long-run co-integration among almost all the variables of the study.

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