Assessment of Private Sector Spending in Construction Sector in South Africa: An Auto-Regression Distributed Lags Approach

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This paper investigates the influence of macro-economic variables on the contribution of the private sector spending in construction sector to the South African economy. The methodology adopted for the study was an ex-post facto survey research because it was based on existing data. Annual data of the construction contributions, GDP, inflation rate and interest rate were collected between 1984 and 2011. The data were extracted from the published sources of the South African National Reserved Bank (SARB); Statistics South Africa (Stats. SA) and Quantec, South Africa. The study makes use of autoregressive distributed lags (*ARDL*) to prove that there is a long run causal relationship between private sector spending in construction and macroeconomic variables, namely, GDP, Real Exchange Rates, GDP in construction sector, interest rates and inflation rate in South Africa.

Keywords: *ARDL, Construction, Macroeconomic variables, Private sector, South Africa*

INTRODUCTION

South Africa economy has been struggling for decades due to the political and economic reasons. In the 1970s to early 1990s, there was economy sanction imposed by the Western economies on the government of South Africa because of the prolonged rule of the apartheid regime, and there were also internal crises due political reason (Dollery, 2003). Gordhan (2014) states that between 1985 and 1986, large number of skilled workers migrated out of South Africa and this incident had a great impact on the economy.

However, 1994 marked the beginning of a democratically elected government in South Africa. According to Harmse (2006) there was an improvement in the macro-economic environment in South Africa when the first democratically elected government resumed power in 1994. This last statement was supported by Ntsama (2010) and Lysenko and Barnard (2011) and that after a prolonged period of declined in the socio-economic growth in South Africa, there was an improvement from mid-1990s, with the introduction of some economic policies by the government.

Meanwhile, to develop South Africa economy and to make it sustainable, sectoral stimulation have to be initiated by government through adequate and sound policies. Keynesian asserts that increasing spending in construction industry can stimulate economic growth. This is because construction sector through its engagement in the provision of capital infrastructure development can enhance growth and sustainable development (Dlamini, 2011).

LITERATURE REVIEW

Macro-economic policies and the construction sector's contributions in South Africa

South Africa is a rapidly changing environment, because of various political, economic and global influences (Mbachu and Nkado, 2007). According to Harmse (2006), in the 1980s and the

1990s, the South African economy was faced with external pressures in the form of economic sanctions by the Western economies, and the ongoing internal structural inadequacies. The era of sanctions led to import substitution and self-sufficient policies on strategic products by the State; and this caused huge government investment in oil from coal, and in the weapons industries. This period of economic recession saw about 420 000 workers lose their jobs (Harmse, 2006).

The unstable macro-economic environment of South Africa, during the sanctions era, improved when the first democratically elected government came into power in 1994 (Harmse, 2006: 21). According to the analysis of the macro-economic environment, as carried out by Frankel, Smit and Sturzenegger (2006), the income per capita increased rapidly during the 1960-1980 period; but thereafter the economy experienced a downward trend that lasted for 15 years. And, it was only from mid-1994, that the economy began its upward trend. Ntsama (2010) and Lysenko and Barnard (2011) state that after a prolonged period of declining economy growth, South Africa has had an improved macro-economic management since the mid-1990s; and this can be attributed to the introduction of inflation targeting by the South African Reserve Bank (SARB), as well as the introduction of the Growth Employment and Redistribution (GEAR) programme in 1996.

However, the improved economic growth in South Africa is very slow; and the impact has not been felt by all the people, because the rates of poverty and unemployment were still very high (Moller, 2007). Cassim (2006) reviewed the economic reform in South Africa within the period between 1994 and 2004, and came to the conclusion that the macro-economic policies in South Africa concentrated more on issues to address macro-economic instability, external pressure, balance of payments crises, and exchange rate volatility, instead of on long-run structural problems, like the problems of employment generation, unequal income distribution, poverty and crimes.

Meanwhile, the unstable macro-economic environment prevailing in South Africa has contributed immensely to the cyclical trends in the output of the construction industry. According to a study carried out by Windapo and Cattell (2013), the key challenges perceived by stakeholders causing the fluctuations and poor performance of the construction industry in South Africa are: The increasing costs of building material; access to mortgage and credits; high interest rates; and the high rate of failure of contracting enterprises. The Construction Industry Development Board (CIDB) (2013) reveals the following on the key challenges faced by sub-contractors as follows: "*The lack of security of payment; bid price pressure from the main contractors; weak management practices; poor attitudes within sub-contracting organizations; and general industry-wide factors, including the lack of working capital, high levels of competition, and skills shortages."*

These above challenges testify to the fluctuations and the poor performance of the emerging contractors. These individuals have all faced some challenges in their bid to deliver infrastructural projects effectively – because of the sharp decline in employment, a decline in NGCF, and the slow execution of construction projects owing to poor capacity, low productivity, poor-quality workmanship, and low profit margins for contractors (Perkins, Fedderke and Luiz, 2005). Dlungwana, Nxumalo, Huysteen, Rwelamila and Noyana (2002) attribute some of the challenges confronting the construction industry to the rapid globalization of the South African economy, whereby large contracting firms are increasing their offshore markets, in order to grow their revenue, and to survive the current economic recession. They went further, by maintaining that, in an attempt of the government to improve the present situation of the industry, the National Department of Public Works (NDPW) was tasked to develop a remedial strategy, which was done. And this then led to the formation of the CIDB, which is now in charge of construction industry development.

Private sector and the economic development in South Africa

Private sector in any economy is regarded as the engine of the economic development and it includes wide variety of actors, such as large private enterprises whose aim is to maximize profits for shareholders, to millions of individuals who are in business activities to support themselves and their family (Reality of Aid Network International Co-ordination Committee, 2012).

International Finance Corporation (IFC) (2011: 3) describes the private sector as a critical stakeholder and partner in economic development of any nation because of the role it plays in provision of income, jobs and good services to enhance the standard of living of the people and to reduce the level of poverty. IFC (2011: 3) continues by elaborating on the challenges confronting the developing nations of Africa such as promotion of growth, creation of jobs, poverty reduction, improved health and education, all these can only be adequately tackled by incorporation of vibrant private sector in government system.

The role of the private sector in the economic development of any nation cannot be under-estimated. According to the African Development Bank Group (AfDB) (2013) the future of millions of people in any economy depends on the private sector; therefore, the public sector must create conducive environment in which it can operate effectively. The problems of the private sector in Africa varies from inadequate government regulations, restrictive policies, poor infrastructure, severe skill shortages, trade restrictions, tariff and non-tariff barriers to export, difficulties in obtaining medium and long-term finance on affordable terms, and a large number of informal operators (AfDB, 2013).

RESEARCH METHODOLOGY

The study assesses the contribution of the South African private section in construction to the economy. The research design adopted in the study is “ex-post facto” type, otherwise known as “causal comparison”. According to Bernard (2006), ex-post facto is a non-experimental research design that is used to explore possible causal relationships among variables that cannot be controlled by the researcher.

The study uses secondary data sources of information because of the nature of the data that were involved and because of the well-developed knowledge in the field of economics; the economic data can easily be sourced from national statistical sources. The sampling design adopted in this study is a non-probabilistic sampling method, this is to avoid the accidental inclusion of deviant cases which is highly possible with these data characteristics. The choice of variables was purposive; since the study is particularly about those variables that impact on the other; and the choice of the variables would need to be a function of the performance of the choice test statistics. The subject of the sampling for the collection of the macro-economic variables is made simpler by the fact that sources are mostly limited to government approved sources.

The data used in the study were extracted from the published sources of the South African National Statistics, such as South African Reserve Bank (SARB); South African Statistics (STATSSA); and Quantec South Africa (QuantecSA). The data were extracted on quarterly basis via an instrument designed for the purpose. The administration of the data collection instrument did not pose any problem since the extraction could be done either at the information unit of the SARB or research unit of the STATSSA.

The variables used in the study were defined as follows: Private Sector Spending in Construction (Private_SP), this is the total cost of completed projects by private sector in South Africa between the period of the study 1984 and 2011 and is measured in million rand; Real Interest Rate (INT_RATE), the real interest rate is the nominal interest rate adjusted for expected inflation rate and is measured as the difference in the nominal interest rate and the expected inflation rate in the economy, is measured in percentage; Real Exchange Rate (RER), the real exchange rate is defined as the nominal exchange rate that takes into account the inflation difference among nations, it is the rate at which a country currency is compared with the currencies of other countries; Gross Domestic Products (GDP), GDP is used to assess level of performance of a country economy with another country, South Africa GDP is measured in billion rand; Gross Domestic Product in Construction Sector (GDP_CONSTR), the output total of the construction over a period of time, it is measured in million rand; Inflation_Rate (INF_RATE), inflation rate is based on the consumer price index, it is a percentage change in the price of goods and services in the economy within a given period of time.

All the data for the study were subjected to estimation as follows: The study employed Auto-Regression Distributed Lag (ARDL) model, developed by Peasaran, Shin and Smit (2001). This approach can be used to test both long-run and short-run dynamics in variables in a study. Meanwhile, this approach is simple to use as compared to other integration techniques for the following reasons: Firstly, the ARDL bound test does not require variables to be integrated of the same order, that is, they can be either I (0) or I (1); Secondly, the test solve the serial correlation and endogeneity problems by specifying appropriate lags, the long-run and the short-run parameters can be estimated simultaneously. Thirdly, the ARDL bound test has superior small sample properties (Pesaran & Shin, 1997; Pesaran, et al. 2001).

DATA ANALYSIS AND DISCUSSION OF FINDINGS

This sector of the study presents the data analysis and discussion of findings. The section begins with the stationary/unit root tests, in order to determine the integration of the variables. Then followed by the determination of the ARDL model.

Stationary/Unit Root Tests

The main objective of the stationary/unit root test is to provide a useful insight into either a deterministic or the stochastic secular component in any time series. To carry out this purpose the following test were performed: Augumented Dickey-Fuller (ADF) test; Phillips-Perron (PP) test; Kwiatkowski-Phillips-Schmidt-Shin (KPSS); and Ng-Perron (NP) test.

However, from all the tests, it was discovered that variables are not consistent to all the tests, especially at all levels. The variables react to all the tests at the first difference and were found to be significant. In conclusion on the stationary/unit root tests, all the variables were regarded to be integrated at the first difference, which is to the order of I (1).

Test for Multi-Collinearity

Test for the multi-collinearity was also carried out because of its importance in model building. Probability value determines the significance of a variable in a model and a variable is said to be significant if it probability value is below 5 percent. Multi-collinearity will cause the probability value to be large in model building. Therefore, test must be carried out to ensure that there is no multi-collinearity among the variables under consideration.

The test carried out discovered there was multi-collinearity and the solution was to remove some of the affected variables such as: Crude oil price; Labour productivity in construction and money supply.

Estimation of Auto Regression Distribution Lag (ARDL) Model

The steps for the estimation of the ARDL model for the study are as follows: To determine whether the variables are stationary and that the variable is not of I (2); Selection of optimal lag; Test for long-run relationship by using Wald test statistics and run ordinary least squares model; Save the residual and copy it as error correction term (ECT) and run ordinary least squares model including ECT as one of the regressors; Ensure ECT is negative and significant. Thereafter, follows the explanation of the results and the diagnostics test.

From the above steps, the stationary/unit root tests for the study revealed that all the variables are of order I (1). The next step is the selection of the optimal lag model. The variable for the ARDL model estimate are: PRIVATE_SP as the dependent variable; other variables are INFL_RATE; INT_RATE; RER; GDP; and GDP_CONSTR as the independent variables.

The model can be expressed as follows:

PRIVATE_SP = F (INFL_RATE; INT_RATE; GDP; RER; GDP_CONSTR)
Where PRIVATE_SP is Private sector spending in construction
INFL_RATE is inflation rate in the economy
INT_RATE is the interest rate in the economy
GDP is the gross domestic products in the economy
GDP_CONSTR is the construction sector contribution to the economy
RER is the real exchange rate in the economy.

For the selection of the optimal lags; the values of Akaike (AIC) and Schwards (SIS) information criteria were considered for various models and the one with the lowest valves of AIC and SIS was taken. The results of the optimal lag selection are summarised in Table 4.1

Table 4.1: Results of optimal lag selection

No of lag	AIC	SIC	Comment
1	-2.14	-1.18	Not the lowest lag
2	-2.09	-1.61	Not the lowest lag
3	-2.17	-1.45	Not the lowest lag
4	-2.56	-1.76	The lowest lag
5	-2.49	-1.52	Not the lowest lag
6	-2.47	-1.33	Not the lowest lag

From the Table 4.1 above, model with four lags is optimal, the best to be used to produce reliable and acceptable model. Thereafter, the model with four lags was tested for serial correlation. The result was that the model has no serial correlation. Also test for stability was carried out and it was discovered that the model with lag four is stable. This is shown in the figure below.

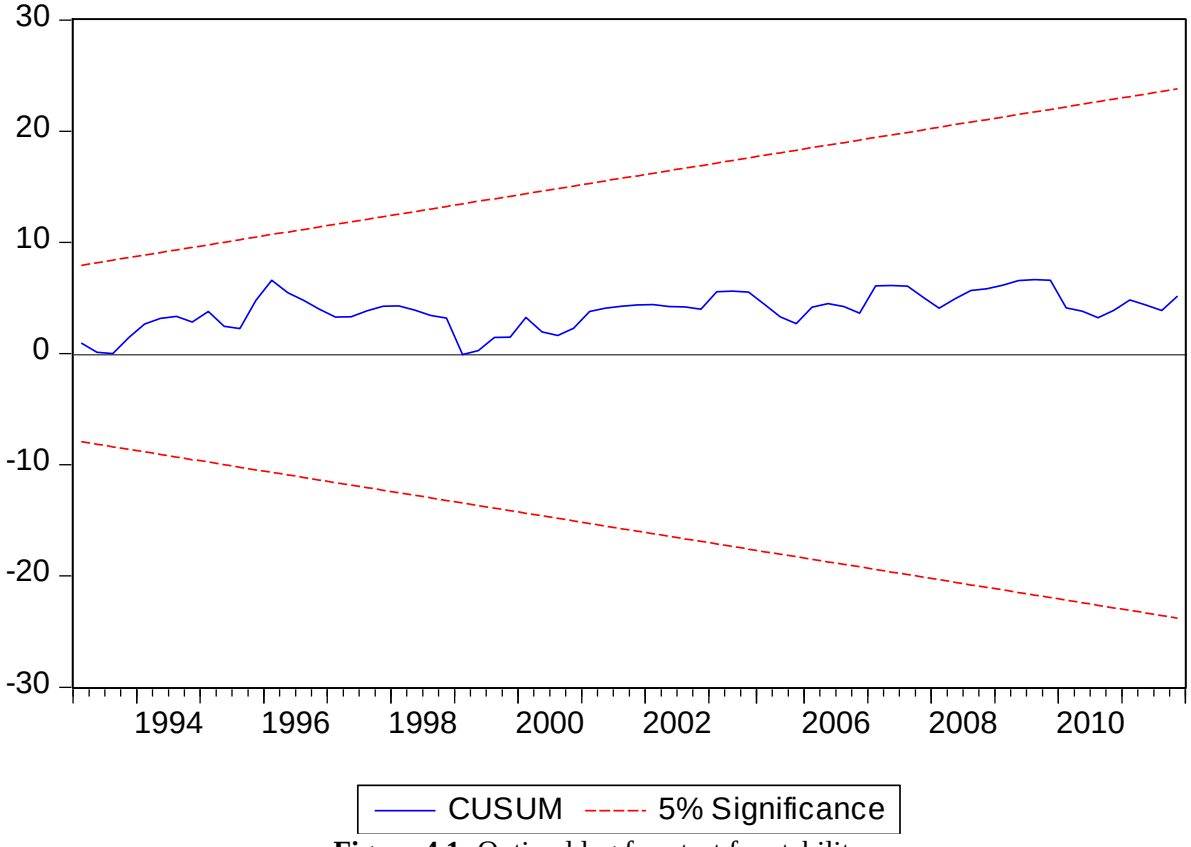

Figure 4.1: Optimal lag four test for stability

The next step is to determine long run model or bound testing using four lags. The results are shown in Table 4.2

Table 4.2: Results of estimated long-run coefficient ARDL model

Variables	Coefficient	T-Statistics	Probability
C1 = Constant	0.570624	1.336896	0.1856
C2 = PRIVATE_SP(-1)	-0.256034	-2534880	0.0135
C3 = PRIVATE_SP(-2)	-0.346896	-3.346441	0..0013
C4 = PRIVATE_SP(-3)	-0.173218	-1.598259	0.1145
C5 = PRIVATE_SP(-4)	0.289232	-2.847396	0.0058
C6 = GDP(-1)	-0.222756	-2521006	0.0140
C7 = GDP(-2)	-0.179141	-2.120194	0.0375
C8 = GDP(-3)	-9.47E-07	-2.735433	0.0097
C9 = GDP(-4)	-7.47E-07	-2.219657	0.1685
C10 = RER(-1)	0.179019	1.391373	0.1685
C11 = RER(-2)	0.273465	1.937374	0.0567
C12 = RER(-3)	-0.052627	-0.407012	0.6852
C13 = RER(-4)	0.008184	0.060844	0.9517
C14 = GDP_CONSTR(-1)	0.480119	0.67148	0.0094
C15 = GDP_CONSTR(-2)	0.462215	2.652248	0.0099
C16 = GDP_CONSTR(-3)	0.421222	2.532573	0.0136
C17 = GDP_CONSTR(-4)	0.547076	3.260778	0.0017
C18 = INT_RATE(-1)	0.089040	4.207859	0.0001
C19 = INT_RATE(-2)	0.011237	0.565730	0.5734
C20 = INT_RATE(-3)	0.014259	0.859781	0.3928
C21 = INT_RATE(-4)	-0.025210	-1.804191	0.0755
C22 = INFL_RATE(-1)	0.129525	1.333104	0.1868
C23 = INFL_RATE(-2)	0.006521	0.065839	0.9477
C24 = INFL_RATE(-3)	0.274534	2.632363	0.0104
C25 = INFL_RATE(-4)	0.085057	0.775772	0.4405
C26 = PRIVATE_SP(-1)	0.038469	-1.900337	0.0615
C27 = GDP(-1)	0.078584	3.874000	0.0002
C28 = RER(-1)	-0.022709	-0.324357	0.7466
C29 = GDP_CONSTR(-1)	-0.188714	-3.691176	0.0004
C30 = INT_RATE(-1)	-0.028188	-1.391719	0.1684
C31 = INFL_RATE(-1)	-0.132496	-3.089133	0.0029

Table 4.2 presents the results of the Wald test for long-run relationship between the dependent variable and the independent variables in the model under consideration that contains four lags.

Meanwhile, after the model estimation then follows the testing long-run relationship using the Wald test and the hypotheses are stated below:

Null hypothesis is that C(26) = C(27) = C(28) = C(29) = C(30) = C(31) = 0
Alternative hypothesis is that C(26) = C(27) = C(28) = C(29) = C(30) = C(31) ≠ 0

Table 4.3: Results of the Wald test for the long-run relationship

Test Statistic	Value	df	Probability
F-statistic	5.126701	(6.70)	0.0002
Chi-square	30.76020	6	0.0000

From the result, the F-statistics is 5.126701 and the probability is 0.0002; while the Chi-square value is 30.76020 with probability value 0.0000.

However, to know whether the variables have long-run association or not, the F-statistic 5.126701 is compared with the Pesaran critical value at 5 percent level. The model is unrestricted

intercept and no trend. From the Pesaran table, the lower bound value is 3.79; and the upper bound value is 4.85.

The guide line principle for acceptability in the Pesaran table is that if the F-statistic is more than upper bound level value we reject null hypothesis and then accept alternative hypothesis.

Therefore, from our Wald test F-statistic is 5.126701 greater than the Pesaran upper bound value of 4.85. That is 5.12> 4.85. From the Wald test the six variables in the model: PRIVATE_SP; GDP; RER: INT_RATE; INFL_RATE and GDP_CONSTR have long-run relationship and can move together in the long-run. Next is to develop model of short-run with error correction term as one of the regressors.

Development of short-run and error correction term (ECT).

Table 4.4 presents the results of the short-run and error correction term (ECT). ECT (-1) is incorporated into the above model to form long-run component. ECT (-1) is the speed up adjustment towards long-run and it must be negative, at the same time be significant.

From the Table 4.4 the following observations were taken on the short-run association between the dependent variables and the independent variables: firstly, only INT_RATE (-1), (-2), (-3) and (-4) can jointly cause short-run causality with PRIVATE_SP. The other variables such as GDP; RER; GDP_CONSTR; and INFL_RATE did not have short-run association with PRIVATE_SP.

Table 4.4: Results of short-run and ECT

Variable	Coefficient	T-Statistic	Probability
C1= Constant	0.003575	0.391716	0.6964
C2= PRIVATE_SP(-1)	0.250492	1.856706	0.0674
C3= PRIVATE_SP(-2)	-0.092698	-0.969825	0.3353
C4= PRIVATE_SP(-3)	0.1103317	1.053663	0.2955
C5= PRIVATE_SP(-4)	0.573009	5.160574	0.0000
C6= GDP(-1)	0.035467	0.517007	0.6067
C7= GDP(-2)	0.041208	0.593963	0.5544
C8= GDP(-3)	-0.038230	-0.519078	0.6053
C9= GDP(-4)	1.03E-07	0.353810	0.7243
C10= RER(-1)	0.116388	0.870204	0.3870
C11= RER(-2)	0.231701	1.627113	0.1080
C12= RER(-3)	-0.196558	-1.440137	0.1541
C13= RER(-4)	0.051169	0.367542	0.7143
C14= GDP_CONSTR(-1)	-0.015909	-0.113630	0.9098
C15= GDP_CONSTR(-2)	-0.010843	-0.074700	0.9407
C16= GDP_CONSTR(-3)	-0.017197	-0.118700	0.9058
C17= GDP_CONSTR(-4)	0.068569	0.482203	0.6311
C18= INT_RATE(-1)	0.053898	3.390943	0.0011
C19= INT_RATE(-2)	-0.042741	-2.402194	0.0188
C20= INT_RATE(-3)	-0.011129	-0.716076	0.4762
C21= INT_RATE(-4)	-0.038681	-2.7021569	0.0086
C22= INFL_RATE(-1)	0.099285	0.669986	0.5050
C23= INFL_RATE(-2)	-0.121388	-1.106820	0.2720
C24= INFL_RATE(-3)	0.229467	2.053836	0.0436
C25= INFL_RATE(-4)	-0.125003	-1.067612	0.2892
C26= ECT(-1)	-0.538070	-2.850634	0.0057

Discussion of Findings

The private sector in construction is found to be an important sector of the economy and the macroeconomic variables such as inflation rate, interest rate, economic growth and the exchange rate have great role to play in the contribution of the private sector in construction to the South African economy. From the Wald test, it was discovered that the macroeconomic variables: GDP, RER, INT_RATE, INFL_RATE and GDP_CONSTR can jointly influence the contribution of the private sector in construction at the long-run.

From the above findings, inflation in the economy would influence the performance of the private sector in construction at the long-run. If at the long-run there is high inflation, this means an increase in the price of construction materials thereby affecting the contribution of the private sector in construction to the economy. This follows the economic theory such as the theory of price which stipulated that when the price of the good rises above its equilibrium level, it demand would be greater than its supply and this happens when there is inflation in the economy. Equally, when the price of a good is above the equilibrium price, supply would be greater than the demand, this incident happens when there is low inflation in an economy.

Interest rate is another variable that influence the contribution of the private sector in construction in the long-run. This follows that high rate of interest rate will reduce development by the private sector in construction thereby affecting their contribution to the economy. This follows the theory of loanable funds, all things being equal a low interest rate would increase investment but when the interest rate is high, investment will be low. The investment would come down when there is high rate of interest rate because the cost of capital has gone up. Also according to the theory of loanable fund, savings is related to interest rate and the volume of savings in an economy will determine the level of investment. When the interest rate is high, the level of savings will be low and when the interest rate is low the level of savings will be high. High savings will affect the contribution of the private sector in construction to the economy.

Economic growth is another important variable affecting the contribution of the private sector in construction to the South African economy in the long-run. This finding was in agreement with past studies by Aiyetan (2010) and Dlamine (2011) that there is a close relationship between the construction industry and the economy of any nation. The private sector in construction in South Africa will contribute more to the economy when there is boom in the economy. Following the Keynesian theory which says that increase in spending in construction industry can stimulate economic growth due to the fact that construction sector engages in infrastructure development.

CONCLUSIONS AND RECOMMENDATIONS

The private sector in the construction industry has been found to be of great importance in the development and sustainable growth of any country; however, the unstable macro-economic environment in South Africa is depriving it of this great benefit.

The aim of this study is to assess the private sector spending in construction sector in South Africa using ARDL approach. ARDL was used because the influence of the independent variable is always felt over time, rather than all at once. It was discovered from the ARDL model that there is a long-run causal relationship between the private sector spending in construction and the macro-economic variables namely: GDP; RER; GDP_CONSTR; INT_RATE; and INFL_RATE in South Africa. On the short-run association, only the INT_RATE (-1), (-2), (-3), and (-4) that can jointly cause short-run causality with the PRIVATE_SP. The remaining independent variables such as GDP; RER; GDP_CONSTR and INFL_RATE did not have short-run association with the PRIVATE_SP.

The recommendations of this study are as follows: firstly, the monetary policy on inflation targeting in South Africa must be properly anchored to withstand any external shocks; secondly,

efforts of the monetary authorities must be geared towards a stable macro-economic environment via policies that would bring about price stability, low interest rate, and a stable exchange rate of Rand to the Dollar; thirdly, the inflation rate in South Africa that is fluctuating and unstable must be addressed by appropriate policy because of its impact on the construction prices.

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LIST OF ABBREVIATIONS

ADF	Augumented Dickey-Fuller
AIC	Akaike Information Criteria
AfDB	African Development Bank Group
ARDL	Auto- Regressive Distributed Lag
CIDB	Construction Industry Development Board
C1……Cn	Variables
GEAR	Growth Employment and Redistribution
GDP	Gross Domestic Product
GDP_CONSTR	Gross Domestic Product in Construction Sector
IFC	International Finance Corporation
INF_RATE	Inflation Rate
INT_RATE	Interest Rate
KSPSS	Kwiatkowski_Phillips- Schmidt-Shin
NDPW	National Development of Public Works
NP	Ng-Perron
PP	Phillips-Perron
Private_SP	Private Sector Spending in Construction
RER	Exchange Rate
SARB	South African Reserved Bank
SIS	Schwards Information Criteria
Stats.SA	Statistics South Africa