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Construction Industry Performance and the Growth of South African Economy: Any Causal Relationship?

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Abstract

The Construction industry is a vital sector of any nation, contributing immensely to economic growth. This study examines the causal relationship between the performance of construction industries and the Gross Domestic Product in South Africa for the period 1995-2018. The Secondary data sourced from Bloomberg, McGregor's database and the World Bank's database were analysed using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP), Dickey-Fuller general least squares (DF-GLS) unit root tests and the Ng–Perron test techniques for unit root test, co-integration and granger causality. The results revealed that the variables were found to be stationary as indicated by the three tests thus, the establishment of a short-run equilibrium relationship for the variables. Moreover, it was established that there exists a bi-directional relationship between Gross Domestic Product and Construction industry performance in South Africa. Therefore, the need for more investment in infrastructure by the government was recommended as the viability of construction industries would create employment opportunities that allow for the development of other sectors of the economy through the multiplier effect and such. The activities and operations of construction industries should be made easier through the provision of favourable business settings.

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1. Introduction

The need for befitting and permanent structures led to the idea of construction, which started from simple tools and temporary shelters. Construction is as old as humans due to its transformation from a nomadic lifestyle to a befitting settlement (Kikwasi & Escalante, 2018).

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The high-scale availability of industrial materials and manufacturing improvement techniques made the development of urbanization possible through construction. Construction involves environmental transformation through bridges, roads, housing, health, water and infrastructure for power generation (Kikwasi & Escalante, 2018). Therefore, it is ascertained that the construction sector is crucial for the socioeconomic development of any nation. Construction sector engenders capital accumulation, job creation and household income. As the driving force for any government investment is unemployment reduction, the eradication of poverty and a high level of economic growth, the sector has potential to bridge inequality in the economy.

South Africa as a developing nation is still faced with many challenges such as unemployment. The unemployment rate increased to 29 percent in the second quarter of 2019 from 27.6 percent in the first quarter, which is the highest rate since the first quarter of 2003[1]. Also, it was observed that despite an increase in GDP from -0.8 percent in the first quarter of 2019 to 0.8 percent in the second quarter of 2019, the contribution of the construction companies operating the South Africa had declined to 106423.38 ZAR million in the second quarter from 106850.38 ZAR million in the first quarter of 2019[2]. This confirms that despite an improvement witnessed in the economy during the period, the contribution of construction companies with unemployment menace have become a serious concern.

Hence, in a bid to curtail unemployment and other challenges such as bridging the income inequality gap, achieving sustainable and equitable economic growth, the republic must identify investment in infrastructure development that can be handled by the construction sector as the way of achieving this goal. According to Anaman and Osei‐Amponsah (2007), government's policy framework must be centered on strategies for prioritizing employment generation and the overall prosperity of the economy through infrastructural developments that can be driven by construction companies. With the nose-diving performance of construction companies in the republic, it is pertinent to inquire if the economic growth of the republic causes their performance and vice versa. The correlation between these two has been established but the causality has not been established in the republic use the company-specific data.

[1] www.tradingeconomics.com, 2019

[2] www.tradingeconomics.com, 2019; https://www.businesslive.co.za/bd/economy/2019-01-04-sa-construction-industry-to-grow-24-in-2019-says-fitch/

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It is against this background that the current study seeks to examine and establish a causal link between the performance of construction companies operating in the construction sector and economic growth. Following this introduction is the literature review, followed by the research method, followed by result and discussion of the results while the concluding remark is the last section.

2. Literature review

The construction sector is important and as such, plays a vital role in enhancing economic growth. Therefore, it was argued that a sector as big as this could not but have an impact on the economy (Dlamini, 2012). It was further argued that economic growth is about boosting the economy. The government boosts the economy to attain growth in order to stimulate job creation. Increased economic activities require a correspondingly enough provision of roads and other infrastructure. According to Lopes, Oliveira, and Abreu (2011), the construction sector is foreseen to play a powerful role in economic growth, in addition to creating structures that add to productivity and the quality of life. It must be noted that large sections of the nation's workforce are active when the sector is working at optimal capacity. This has made the construction sector labour-intensive. Hence it was believed that construction activity follows economic growth.

The key factors contributing to the growth of construction companies in Malaysia have been examined by Bakar, Tabassi, Razak, and Yusof (2012) in order to identify the factors that may have important roles in determining growth and their impact on growth performance in these companies. They used primary data collected from 600 survey questionnaires sent through the mail to respondents from large companies in the construction sector of grade G7 as classified under the Construction Industry Development Board of Malaysia (CIDB). Only 102 questionnaires were returned and have been analyzed by using the relative importance index (RII), regressions and analyzing confirmatory factor. Their results showed that orientation factors of customers play crucial parameters in selecting progress in Construction companies in Malaysia. Furthermore, management and product quality factors, as well as human factors have a positive significant effect on growth performance.

The role of the construction industry and its influence on economic growth in the Indian economy were investigated by Mallick and Mahalik (2010). They revealed a weak and unclear dominant impact of capital stock on the construction sector in that country. It was further

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shown that there is a strong effect of the construction industry on economic growth when there is a failure in capital stock, thus leading to enhanced employment generation from the construction industry. However, it can be emphasized that an increase in employment generation from the construction sector leads to increased output, which in turn increases economic growth. Moreover, the impact of analyzing the construction sector's effect on economic development and the income of households in South Africa was examined by Mosenogi (2014). The author adopted the application of the Social Accounting Matrix (SAM) to provide insight into the link between economic growth, the construction industry and household income in South Africa. Mosenogi (2014) discovered a crucial role of the construction sector in the economy through the provision of infrastructure stock or capital accumulation and, as such, increased social and economic activities. It was further revealed that the construction industry remarkably contributed to employment, household income and economic growth.

Oladinrin, Ogunsemi, and Aje (2014) investigated the fundamental association between construction growth and economic growth in a comparative study of Nigeria and South Africa. The aim of their study was to assess the influence of the construction sector on the aggregate economy. Moreover, the secondary data gathered on the comprehensive national GDP and construction output for the period of 20 years was examined using Unit root and Granger causality test techniques. The result revealed that a significant uni-directional relationship exists between GDP and construction output in South Africa. This indicated that the construction sector had the opportunity to enhance the economy of the nation and vice versa. Thus, it may be emphasized that the growth in the aggregate economy of both countries influenced the growth of construction output. Moreover, significant growth in construction output in South Africa was discovered to be a good predictor of GDP growth in Nigeria, whereas GDP growth in the South Africa was not influenced by the growth in construction sector of Nigeria.

In another paper, the impact of economic fluctuations on the performance and growth of the Nigerian construction sector was investigated by Okoye, Ngwu, Ezeokoli, and Ugochukwu (2016). They used secondary data to evaluate aggregate GDP and the construction sector, sourced from the National Bureau of Statistics (NBS) with data from 2010 to 2015. Moreover, the unit root test, co-integration test, Granger causality test and the ordinary least square

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regression method have been used in this study. The result revealed that the economic variables under consideration were stationary at the level. It was also discovered that contemporaneous long-run equilibrium associations exist amongst the variables. Furthermore, the result revealed an insignificant negative relationship between GDP and the construction sector. More interestingly, the growth rates of GDP were less volatile than that of the construction sector. Hence, it needs positive and constructive policies that drive the construction sector due to potentials of economic improvement and recovery from recession.

Khan, Liew, and Ghazali (2014) used the Granger causality test to determine the link between investment in the construction sector and growth in GDP rate in Pakistan over the period 1950 to 2005 and found a uni-directional relationship between economic development and the construction sector. As a result, it can be emphasized that investment in the construction sector was a good determinant of GDP growth. Similarly, Berk and Biçen (2017) empirically investigated the causal relationship between the same variables in emerging countries and they used the same test to examine the secondary data gathered from 2000 Q1 to 2016 Q2. Moreover, they found that in Turkey the relationship between those variables is causal and it can be emphasized that incentives applied to the construction sector, such as actual spending on construction, may have a critical effect on economic growth.

In a paper on the comparative analysis of the association between aggregate output and the construction sector in Sub-Saharan African countries, a panel-generalized method of moments was used and a positive effect was shown between the construction industry and growth (Alagidede & Mensah, 2018). Moreover, in their sample, the non-linear relationship between output growth and construction was considerably reduced. The researchers suggested that construction growth in sub-Saharan African countries has been trivial because they have not reached the development stage. Additionally, the study showed that comparing East Africa to West and Southern Africa showed a strong impact of development on economies through construction. Authors like Tiwari (2011) used data from the1950 to 1951 and 2008 to 2009 periods to determine the connection concerning construction investment and economic growth for the Indian economy. Moreover, they approved the unit root test, co-integration and Granger causality test for the short-and long-term and they showed a bi-directional causal relationship between those variables. Hence, they recommended that in the short-run, policies should encourage investments in the construction

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sector, while their focus should be less in the long-term.

During the period 1998, Q1 to 2014 Q4 in Turkey, the relationship between investment in constructions and developments in the economy were investigated by Erol and Unal (2015). They tested three variables, namely growth in the construction industry, growth of real GDP and the real interest rate by using the Granger causality test which assumes a VAR model in a multivariate setting. Their results indicate that there are two to four quarters of economic growth that exceeds construction activities but are not opposite because it has short-term effects on economic growth and cannot offer stable explanations for economic complications. A significant number of jobs can be created by the construction sector. This may increase investments and growth in other sectors of the economy.

3. Research Method

Data Source and Scope of Study

Secondary data sourced from Bloomberg, McGregor's database and the World Bank's database were used for this study. Fourteen (14) listed construction companies in South Africa with regularly published annual reports and accounts were used from the years 1995-2018. The reason for the choice of these 14 companies is data availability. All other construction companies do not publish their annual financial statements regularly. These chosen companies are well organized such that the relationship of construction companies and SA growth after democracy is revealed.

Table 1: Description of Variables

Proxies	Variables	Measurement
ROA	Performance measures	PAT/ Total Asset
GRT	GDP growth rate	
YEX	Year of existence	Log of year of existence
SIZ	Company size	Log of the Total Asset

Source: Researchers (2019)

Estimating Techniques and Model Specification

Due to the non-stationarity of the economic variables and to avoid spurious inferences from the results, the stationary test was carried out on the economic variables under study. Moreover, a co-integration test was carried out on the variables to establish the long-run equilibrium relationship. The error correction mechanism that determines the extent to which maladjustment in

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the short-run and long-run dynamics of the model can be corrected was estimated. Additionally, the Granger causality test that determines the direction of causality amongst the variables was estimated.

Granger Causality Test Model

This technique was used to determine whether one-time series was useful in predicting or forecasting another. The causality defined by Granger (1969) and Sims (1980) is inferred when the value of the variable has explanatory power of another. The basic empirical question in this study was whether the GRT, YET and SIZ under consideration significantly affect the ROA of construction firms in South Africa. The Granger causality test was employed to ascertain the direction of causality between the ROA, GRT, YET and SIZ in this study. The test procedure described by Granger (1969) is given as follow:

$$ROA_{it} = \sum_i^h (\psi_i ROA_{it-i} + ß_{1i} GRT_{it-i} + ß_{2i} YET_{it-i} + ß_{3i} SIZ_{it-i} + £_{1t})$$

$$GRT_{it} = \sum_i^h (\psi_i GRT_{it-i} + Ʊ_{1i} YET_{it-i} + Ʊ_{2i} SIZ_{it-i} + Ʊ_{3i} ROA_{it-i} + £_{2t})$$

$$YET_{it} = \sum_i^h (\psi_i YET_{it-i} + \gamma_{1i} SIZ_{it-i} + \gamma_{2i} ROA_{it-i} + \gamma_{3i} GRT_{it-i} + £_{3t})$$

$$SIZ_{it} = \sum_i^h (\psi_i SIZ_{it-i} + Y_{1i} ROA_{it-i} + Y_{2i} GRT_{it-i} + Y_{3i} YET_{it-i} + £_{4t})$$

The equation above postulates that current ROA_{it} was related to past values of itself as well as that of other variables, and vice versa. Uni-directional causality from GRT_{it} to ROA_{it} is an indication that the estimated coefficients on the lagged GRT_{it} in the above equations were statistically different from zero as a group. That is $\sum_{i=1}^h ßi \neq 0$ and the set of estimated coefficients on the lagged ROA_{it} was not statistically different from 0. That is $\sum_{i=1}^h \psi i = 0$. The converse was the case for uni-directional causality from ROA_{it} to GRT_{it}.

Estimate by OLS and a test for the null hypothesis GRT_{it} does not Granger Cause ROA_{it}

Unrestricted sum of squared residuals $RSS_1 = \sum_i^h £_{1t}^2$

Restricted sum of squared residuals $RSS_2 = \sum_i^h £_{2t}^2$

$$F = \frac{(RSS1 - RSS2)/p}{RSS1/T-2P-1}$$

Reject the null hypothesis if $F > F_\alpha (P, T-2P-1)$. Then, causality exists when the sets of GRT_{it} and ROA_{it} coefficient are statistically different from 0 in both regressions (Gujarati, 2009).

4. Results and Discussion

This section deals with the analysis and discussion of the various tests being carried out in this study.

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Stationary test

The unit root test carried out in this study was done by the augmented Dickey–Fuller (ADF) test proposed by Dickey and Fuller (1979). This was supplemented with the DF general least squares (DF-GLS) unit root tests and the Ng–Perron tests to detect the stationarity of the variables in cases where ADF failed. The results presented in Table 2 were obtained from stationary tests performed at level and at first difference on the variables under consideration in this study.

Table 2: Unit Root or Stationary Test

Variables	ADF (level)	ADF (first difference)	DF-GLS (level)	DF-GLS (first difference)	Ng-Perron Test			
					MZ_a	MZ_t	MSB	MST
ROA	7.301^{*0}	12,279^{*0}	2.392^{*1}	2.736^{*0}	21.554^{*0}	3.282^{*0}	0.152	1.136
GRT	11.161^{*0}	11.925^{*0}	4.132^{*0}	13.155^{*0}	29.365^{*0}	3.827^{*0}	0.130	0.846
YEX	3.844^{*0}	15.077^{*0}	2.574^{*1}	15.115^{*0}	12.533^{*1}	2.492^{*1}	0.198	1.997
SIZ	3.277^{*1}	12.052^{*0}	0.571	10.854^{*0}	78.354^{1}*	6.248^{1}*	0.079	0.335

^{*2} = 10% Significance, ^{*1} = 5% Significance and ^{*0} = 1% Significance, ^{1}* = 1% Ng-Perron Significance for first difference

In Table 2, a test for stationarity or unit roots was presented to determine the ADF, DF-GLS and the Ng–Perron tests. In determining the exact order for the stationary tests, the AIC automatically selects the appropriate lag length based on the size of the data sets used for this study. Thus, it was discovered from the ADF test that the ROA, GRT and YEX at level and first difference were stationary at a 1% level of significance, while SIZ at level and first difference was stationary at a 5% and 1% level of significance respectively. The DF-GLS revealed that the ROA and YEX were stationary at a 5% and 1% level of significance at level and first difference respectively. The result showed that GRT at level and first difference was stationary at a 1% significance level, while SIZ at level was non-stationary but its first difference was stationary at 1% significance level. However, the Ng-Perron de-trended test using MZa and MZt statistics revealed that at level ROA and GRT were stationary at a 1% significance level while, at level the YEX was stationary at 5% level of significance. The result of MZa and MZt statistics further revealed that SIZ only became stationary after the first difference at a 1% level of significance.

Hence, all the variables under consideration in this study were stationary as indicated by the three tests thus, led to the rejection of the assumption of non-stationarity for the variables. The establishment of the short-run equilibrium relationship for the variables which indicated the impact of the GDP growth rate (GRT) on the return of an asset (ROA) led to the test for the long run stability of the linear combination of the variables through the co-integration test, presented as follows in Table 3.

Co-integration amongst variables

The next possible test after the unit root was the panel co-integration test for the variables under study. The Johansen Trace test statistic and Maximum Eigenvalue statistic was adopted in this study. The results of the co-integration tests being carried out are presented in Table 3, with the assumption that there is no co-integration amongst the economic variables.

Table 3: Panel Co-integration test

Unrestricted Co-integration Rank Test (Trace)					Unrestricted Co-integration Rank Test (Maxi-Eigenvalue)			
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	Prob.	Eigenvalue	Max-Eigen Statistic	5% Critical Value	Prob.
None *	0.999	978.758	60.061	0.000	0.999	888.217	30.439	0.000
At most 1 *	0.408	90.540	40.174	0.000	0.408	64.491	24.159	0.000
At most 2 *	0.181	26.049	24.276	0.030	0.181	24.694	17.797	0.004
At most 3	0.009	1.355	12.320	0.985	0.009	1.209	11.224	0.985
At most 4	0.001	0.145	4.129	0.753	0.001	0.145	4.129	0.753

Trace test and Max-eigenvalue test indicates 3 cointegrating equation (s) at the 5% level. * means rejection of the hypothesis 5% level

The Trace test and Maximum eigenvalue statistic for co-integration test presented in Table 3 revealed the existence of 3 co-integrating vectors at the 5% level of significance. This implies that the economic variables under investigation were co-integrated and thus establish the stability and equilibrium relationship amongst the economic variables considered for this study in the long run. Following normalization of

the above co-integrated vector, it can be inferred from this study that in the long run, the GDP growth rate (GRT) had an impact on the return on assets (ROA) of South African construction companies.

Causality Tests

Table 4: Results of Causality Tests

	D(ROA)		D(GRT)	
C	568.136 (0.000) *		522.708 (0.000) *	
	F-Statistic	Chi-Square	F-Statistic	Chi-Square
D(ROA)	0.725 (0.72)	9.014 (0.70)	1.488 (0.14)	17.168 (0.14)
D(GRT)	2.165 (0.02) **	23.483 (0.02) **	0.680 (0.77)	8.492 (0.75)
D(YEX)	7.166 (0.00) *	53.801 (0.00) *	7.309 (0.00) *	54.399 (0.00) *
D(SIZ)	4.913 (0.00) *	42.823 (0.00) *	4.708 (0.00) *	41.645 (0.00) *
ECM_{t-1}	**-0.233 (0.54)**		**-0.471 (0.76)**	
Adj. R^2	0.32		0.75	
Serial Correlation LM Test	201.333 (0.00) *		176.407 (0.00) *	

***Significance at 10%, **Significance at 5% and *Significance at 1%

The short-run causality test results presented in Table 4 reveal that GDP growth rate (GRT), year of existence of the construction companies (YEX) and their size (SIZ) Granger caused the return on assets (ROA) of the construction companies under investigation in South Africa as indicated by the F-statistic and Chi-square statistic text along with their associated probabilities for strong and weak causality at a 5% and 1% level of significance respectively. The non-rejection of the assumption of non-causality between the GDP growth rate and the return on assets in the results implies the importance of GDP growth rate in causing an improvement in the return on assets of construction companies in South Africa. It was also discovered that only the year of existence and the size of the construction companies is Granger caused by the GDP growth rate in South Africa. The F-statistic and the Chi-square value with their associated probabilities indicated the insignificance of the return on assets of the construction companies in Granger causing the GDP growth rate. The error correction mechanism

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(ECM_{t-1}) in Table 4 was the coefficient of the first order lagged of the residual and it must be negatively signed. Thus, the values of the error correction term for both models where the dependent variable was return on assets of the construction companies and the GDP growth rate in South Africa respectively was correctly signed.

It was revealed that the coefficient of ECM_{t-1} was less than zero as expected and, in that case, negatively signed in the model. The value of the coefficient of the error correction term showed the rate at which maladjustment in the equilibrium or long-run relationship amongst the variables under consideration can be corrected. In this study, the model where return on assets of construction companies and the GDP growth rate were dependent variables respectively revealed that there would be a 23% and 47% rate of adjustment to the equilibrium or long-run relationship in the model. The non-causality from the return on assets of the construction companies to GDP growth rate may be a result of a high percentage of the error correction mechanism in adjusting to the equilibrium or long run relationship in the model. Furthermore, the adjusted R^2 in the models revealed that 32 percent variations in the return on assets of the construction companies can be explained by the GDP growth rate and other control variables. This study also revealed that a 75 percent variation in the GDP growth in South Africa can be explained by the return on assets of construction companies, along with their year of existence and size.

Table 5: Pairwise Granger Causality Tests

Null Hypothesis:	Obs.	F-Statistic	Prob.	Remarks
GRT does not Granger Cause ROA	149	3.99796	0.0204**	GRT Granger Cause ROA
ROA does not Granger Cause GRT	149	3.23538	0.0422**	ROA Granger Cause GRT
YEX does not Granger Cause ROA	152	0.40747	0.6661	Ho Accepted
ROA does not Granger Cause YEX	152	2.53690	0.0826***	ROA Granger Cause YEX
SIZ does not Granger Cause ROA	152	0.99235	0.3732	Ho Accepted
ROA does not Granger Cause SIZ	152	7.14081	0.0011*	ROA Granger Cause SIZ
YEX does not Granger Cause GRT	195	0.04857	0.9526	Ho Accepted
GRT does not Granger Cause YEX	195	1.37997	0.2541	Ho Accepted
SIZ does not Granger Cause GRT	149	0.28248	0.7543	Ho Accepted

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GRT does not Granger Cause SIZ	149	10.4552	6.E-05*	GRT Granger Cause SIZ
SIZ does not Granger Cause YEX	152	0.62467	0.5369	Ho Accepted
YEX does not Granger Cause SIZ	152	0.72925	0.4840	Ho Accepted

***Significance at 10%, **Significance at 5% and *Significance at 1%

The results presented in Table 5 supported the importance of the GDP growth rate (GRT) causing the return on assets (ROA) of the construction companies on one hand; whilst on the other hand, the return on assets (ROA) of the construction companies causing the GDP growth rate (GRT). This implies that there were bi-directional relationships between the GRT and ROA of the construction companies under study. The F-statistic values and their associated probability values at a 5% level of significance revealed that statistical significance led to the rejection of the assumption of no bi-directional causality between return on assets of the construction companies and the GDP growth rate in South Africa. The result also statistically revealed that the F-statistic value cannot be rejected for the uni-directional causality between the ROA and YEX and ROA and SIZ. Hence, return on assets of the construction companies granger caused the company's year of existence and size at the 10% and 1% levels respectively. The F-statistic value further indicated that there was not enough evidence to reject the hypothesis that a uni-directional causality exists between the GRT and SIZ. This result emphasized that GDP growth rate in South Africa granger caused the size of the construction companies under study.

5. Concluding Remarks

An in-depth examination of the causal relationship between construction company performance and GDP growth rate in South Africa revealed that all the variables were stationary as indicated by the three tests. Thus, there was rejection of the assumption of non-stationarity for the variables. The establishment of the short-run equilibrium relationship for the variables indicated the impact of the GDP growth rate on the return of an asset and the establishment of the stability and equilibrium relationship amongst the economic variables considered for this study in the long-run in South Africa. This affirmed the position of Okoye et al. (2016) which emphasized that the economic variables under consideration were stationary at the level and that a long-run equilibrium contemporaneous relationship exists between economic growth and the performance of the construction sector. The non-rejection of the assumption of non-causality between the

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GDP growth rate and the return on assets in the result implies the importance of GDP growth rate in causing an improvement in the performance (return on assets) of the construction companies in South Africa in the short run. This result affirmed the earlier result obtained by Berk and Biçen (2017), Oladinrin et al. (2014) and Khan et al. (2014) which established a uni-directional relationship between GDP and construction output in South Africa.

Therefore, it was emphasized that GDP granger causes construction output in South Africa in the short-run, which is contrary to the long-run result where the GDP growth rate caused return on assets of the construction companies on one hand and return on assets of the construction companies causing GDP growth rate. This implies that there was bi-directional relationship between the GDP growth rate and return on assets of the construction companies under study. This, according to Mosenogi (2014), showed that the construction sector plays a crucial role in the growth of the economy.

6. Recommendations

It is recommended that there is a need for positive and constructive policies as the driver of the construction sector due to the potentials of improving on economic growth, since it was noted that investment in the construction sector is a good determinant of GDP growth. Furthermore, economic growth in South Africa is seen as a driver of the construction sector, the construction sector creates significant employment which allows more investment and development of other sectors of the economy through the multiplier effect. This as such justifies the need for more investment in infrastructure. The activities and operations of construction companies should be made simple via the provision of favorable business settings.

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