Economic Development, Technological Change, and Growth

Demand Forecasting and Measuring Forecast Accuracy in a Pharmacy

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Abstract: This study examines the application of structured forecasting methods to determine accurate demand forecasts using 12 monthly sales figures of a moderate busy pharmacy. The date were analysed using some forecasting techniques; Moving Average Method, Exponential Smoothing Method and Least Square Method. Also, the performances of the forecasting methods were evaluated using some accuracy measures such as Mean Absolute Deviation (MAD), Mean Square Error (MSE) and Mean Absolute Percentage Error (MAPE) to. The findings reveal that exponential smoothing method which results to least forecast error is the best method. Hence, the pharmacy is advised to adopt this best forecasting method to determine its monthly demand forecasts. Pharmacy operators should maintain sound sales and inventory records; it is easier if the system can be computerized but it could be expensive to operate for small pharmacy outlet.

Keywords*:* Forecasting methods; pharmacy; performance; demand forecast and accuracy measures

JEL Classification: M11; M31

Introduction

Forecasting has always been an attractive research area since it plays an important role in business planning process (Chao, Jamie & Jonathan, 2017). With rapid and often unpredictable changes in economic and market conditions, managers are making decisions without knowing what will exactly happen in future (Chan, 2000). To achieve competitive advantage in an environment subject to constant fluctuations, organizations have to make correct and timely decisions based on accurate information-forecast (Cassia, Claudimar & Liuz, 2010; Rakesh & Dalgobind, 2013). All decision making processes in the organization requires not just forecasts but accurate forecasts in order to select proper actions relevant for demand and sales planning, production planning, inventory control and so more. Demand planning is a fundamental business exercise that focuses on the forecasting of future actions

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which is a required for efficient supply chain operations and overall firm profitability (Yaro, Brent, Travis & Matthew, 2015) and retail pharmacy is not an exception.

Accurate forecast is a requirement for optimal inventory control and customer demand and reduction of operational costs (Olimpia, Nela & Camelia, 2016). Accurate forecasts help companies prepare for short and long term changes in market conditions and improve operating performance (Wacker & Lummus, 2002). Chihyun and Dae-Eun's (2016) study also confirmed that accurate demand forecasting is important for sustaining the profitability of the firm. This is because demand forecasts influence the firm in various ways, such as, in strategy-setting and developing production plans. Gupta, Maranas, McDonald and Doganis, (2000) asserted that exact sales forecasting is utilized for capturing the tradeoff between customer demand satisfaction and inventory costs. For this usefulness, especially in this recent rapid changing and less predictable business environmental variables, managers and academics have no choice but to devote more attention to how forecasting can be improved to increase demand forecast accuracy (Gilliland, 2011; Rakesh & Dalgobind 2013) In a retail pharmacy, successful sales forecasting systems can be very beneficial, due to the short expiring dates of many pharmaceutical products and the importance of the product quality which is closely related to the human health (Doganis, Alexandridis, Patrinos & Sarimveis, 2006 as cited by Neda, Mohammad & Hamid, 2014). As accurate demand forecasting is crucial to manufacturing companies and it must be taken more seriously in retail outlets such as supermarkets and retail pharmacy because of the high stock level, high customer needs and traffic they experience daily.

Generally, achieving forecasting accurate demand is difficult (Chihyun & Dae-Eun, 2016; Noorfa & Andrew, 2009) and the reasons for difficulty are due to several factors; (i) large variances between actual sales and demand, and (ii) no sales force forecast accountability (Xabier, 2017), (iii) product characteristics in terms of the product life cycle (PLC) (Chihyun & Dae-Eun, 2016), (iv) sources and information-gathering processes (e.g., what information should be collected, where and how it should be collected), (v) approaches to be adopted (e.g., who should be in charge of forecasting, and what roles should be designed), measurement of accuracy (e.g., using the proper metric and defining proper incentive mechanisms), (vi) and using of unstructured forecasting techniques (Kalchschmidt, 2010). In Pharmaceutical business especially retail pharmacy, forecasting the accurate demand for drug and medical supplies is a difficult task (Noorfa & Andrew, 2009) and one of the problems is the lack of a reliable inventory management system which should provide useful forecasting information (Ilma & Mursyid, 2013; Cadeaux & Dubelaar, 2012). Also, high demand volatility of numerous products faced by retail pharmacy (Papanagnou & Matthews-Amune, 2017) resulted to inaccurate demand forecasts. Betts (2014) opined that one major consequence of demand volatility is the increasing inaccuracy of forecasts which have resulted in excessive stocking leading to expiries and losses

especially when considering products with a predetermined shelf life. Considering, the high varieties of products and demand volatility pharmaceutical products, continuous evaluation of fluctuations of inventory is critical to accurate demand forecast, customer satisfaction and overall firm profitability.

Retail pharmacies are a popular choice in low-income countries like Nigeria, Ghana, Togo, etc., for individuals seeking healthcare for minor ailments as a result of the ease of access as compared to the bureaucratic processes, cost and time involved in hospital visitations. Also, in many smaller towns where hospitals are unavailable or reside in bigger cities, retail pharmacies are the first point of call for treatment and advice (Yadav, 2015). Retail pharmacy is confronted with several challenges, including high customer orders and traffic, high stock level, stiff competition, and tough government regulations and levies. It has to continually meet their customers' needs by stocking and delivering the right amount of products (medicines) at the right time.

In retail pharmacy, one of the major problems is the inability to predict the quantity of each drug and classes of drugs should be kept in the inventory (Neda, Mohammad, Sepehri & Hamid, 2014). Despite the high stock level of product varieties in retail pharmacy the forecasting for each drug or class of drugs (anti-malaria, analgesic, hypertensive, blood tonic, cough relief, injections, bone cares, ulcers multivitamins, etc.) are related. On this note, the study adopted top-down approach to forecast the aggregate products where percentages can be allocated to drugs or the individual class of drugs. Bottom-up is another approach where one could forecast for each part and then sum up the whole. The latter approach seems best when there is reasonably good information on sale records of each drug. Despite the fact that empirically, the bottom-up approach is more accurate (MacGregor, 2001), which implies that it can generate more precise demand forecasts but it was not considered in this study owing to inapplicability. Reasons been that, most Nigerian retail pharmacy stores are not automated in terms of inventory control and sales records, so they manually generate total daily or monthly sales figures for all products not each product (drug) sales figures. Thus, sale figures cannot be easily generated for individual products. It is pertinent to mention that the survey reveals that most if not all retail pharmacy stores in Sango-Ota, Ogun State unconsciously rely on qualitative and naïve forecasting methods which produce far less accurate demand forecasts. Considering these situations and the fact that the quality of demand forecasting, as indicated by its accuracy, required improvements as it did not meet expectations Therefore, this study examines how to increase the operational efficiency of the retail pharmacy by improving the accuracy of sales forecasts using a combination of quantitative forecasting techniques and forecast accuracy measures.

Literature Review

Forecasting Method

Forecasting is the art and science of predicting future events. It may involve taking historical data and projecting them into the future with some sort of mathematical model (Özlem, 2016). Adedayo, Ojo and Obamiro (2006) posited that forecasting involves the use of historical data, past experience, intuition, personal values and opinion to project future event. It is pertinent to mention that scientific forecasts are possible only when a historical data are available to project the future occurrence. Literature indicates that studies of structured forecasting techniques has been undertaken to improve on demand forecasts accuracy (Rakesh & Dalgobind, 2013; Chindia, Wainaina & Pokhariyal, 2014). Using Structured forecasting techniques refers to the use of quantitative (such as moving average, weighted moving exponential smoothing and regression) and/or qualitative approaches (such as the Delphi method, consumer representative method and panel of experts), rather than naïve methods, to elaborate sales forecasts. Quantitative techniques use specified and systematic procedures, whereas qualitative techniques involve aspects such as intuition, personal judgment, and experiences. Despite the plethora of studies on this issue, debate is still open on whether the adoption of structured forecasting techniques is always beneficial in improving forecast accuracy. In particular, during the last decade, several authors have challenged the assumption that: the greater the adoption of complex forecasting techniques – the better the forecast accuracy. For instance, many authors attempted to demonstrate that the efficacy of forecasting techniques in improving forecast accuracy depends on the fit between the type of technique adopted and the context (Makridakis et al., 1998; Sanders & Manrodt, 2003). Moreover, several researchers suggested that complex forecasting technique adoption is not enough to guarantee good forecast accuracy (Armstrong, 1987; Mentzer & Bienstock, 1998; Moon et al., 2003).

Qualitative and Quantitative Forecasting Methods

According to Adedayo et al, (2006) and Cassia, et al, (2010), qualitative forecasting method which is subjective in nature involves the use of soft data like the decision maker's experiences, personal values, intuition, emotions and judgmental in reaching a forecast. Some of the common types of qualitative forecasting methods are; (1) Delphi Method, Sales Force Composite, (iii) Consumer Survey, (iv) Jury of Executive Opinions. Quantitative techniques use specified and systematic procedures in analyzing past or historical data by studying the pattern and projecting the pattern into the future using several methods to make a forecast. Generally, this method is assumed to be objectives because it's scientific in nature. Quantitative techniques fall into two categories; (i) trend projections using time series model and

(ii) casual method. Trend projection which is the focus of this study which is further divided into smoothing methods (moving average forecast and exponential smoothing) and time series decomposition. The commonly use quantitative forecasting techniques in the developing economy like Nigeria that has limited access to sophisticated quantitative forecasting methods and facilities are relatively simple methods. Some of the relatively simple forecasting methods include among others; naïve method, moving averages method, weighted moving average method, exponential smoothing method and regression analysis.

Hybrid Forecasting Method

A third forecasting model is a hybrid of qualitative and quantitative methods of forecasting. This combination allows the use of hard data (historical data) and soft data (decision maker's intuition experiences, emotions, values and judgment) to predict more accurate forecasts. The combination process is dependent on the accuracy of performance forecasting a firm aims to achieve by either minimizing the Mean Square Error (MSE) of the resulting forecasts or combining forecasts to attain a simple average of the different forecasts used in the combination (Chidina et al, 2014). Combining forecasts therefore, tends to even-out uncertainties within the different forecasts used, but erratic changes in market rivalry could render this method less accurate. As useful as combining forecasting methods to generate more accurate forecasts is, it is pertinent to understand that application depends largely on the level of demand. In more demand volatile settings like Nigerian business environment where there is frequent changes of business indicators, combination of qualitative and quantitative methods of forecasting may not adequately predict future sales, so therefore, application of quantitative demand forecasting method(s) to determine future sales of retail pharmacy outlet is recommended. This decision is validity by (Cassia, Claudimar & Liuzs's, 2010) study.

A combination of simple structured forecasting methods such as simple moving average, exponential smoothing and least squared method were used to analyse past twelve (12) months sales data of a pharmacy in this study. Researches on time series forecasting argues that predictive performance increases through combined forecasting techniques (Kumar & Dalgobind, 2013; Armstrong, 2001). Bunn and Taylor (2001) got considerable improvements in accuracy when they combined judgmental forecasting method with a statistical method. Hibon and Evgeniou's (2005) study is of the opinion that selecting among combinations is less risky than selecting among individual forecasts. It was on these premises that a combination of simple quantitative forecasting methods was selected for this study. The performance of forecasting methods varies according to the accuracy measures being used **(**Makridakis & Hibon, 2000). Therefore, estimating the performance of forecasting

methods involves the application of some accuracy performance measures (Nijat, Davis, Peter & Peter, 2016).

Forecasting Accuracy Measures

In the past studies, various accuracy measures have been proposed, discussed and applied by many studies as evaluation criteria for forecasting methods (Nijat, Davis, Peter & Peter, 2016; Pradeep & Rajesh, 2014). Forecast accuracy measures provide necessary and decisive feedback to decision makers in order to use the better forecasting which associated with least forecast error. Due to large forecast errors which usually negatively affect companies' operational performance, forecast accuracy is often considered as a necessity (Danese & Kalchschmidt, 2011). Forecast accuracy in supply chain is typically measured using the Mean absolute deviation (MAD), Mean squared error (MSE) Adedayo, et al, 2006, Hyndman and Koehler, 2006) and mean absolute percentage error (MAPE) (Mathai, Amathai, Agarwal, Angampalli, Narayanan & Dhakshayami, 2016). The forecasting errors challenge the overall accuracy of the forecasting methods no matter how simple or sophisticated.

This study intends to evaluate the accuracy of the forecasting methods (i. moving averages method, ii. simple exponential smoothing method, iii. least square method) using mean forecast error (MFE), mean absolute deviation (MAD) and mean square error (MSE). This is in similar to the study conducted by Pradeep and Rajesh, (2014) except the addition of root Mean Square Error (RMSE) which is the squared root of MSE. Paul (2006) applied the forecast accuracy measures to evaluate naïve forecasting technique. Matsumoto and Ikeda (2015) adopted the forecast error measures in examination of demand forecasting by time series analysis for auto parts remanufacturing. Nijat, Davis, Peter and Peter, (2016) did a detailed description of accuracy measures and the performance of the prediction models are evaluated using a chosen dataset from the UCI Machine Learning Repository. Mathai, Amathai, Agarwal, Angampalli, Narayanan and Dhakshayami, (2016) instead used their newly developed accuracy forecast method; Symmetric mean average percentage error and other popular accuracy measures to measure the accuracy of forecast of the sales of the ten products various industries with products having intermittent demand. Rakesh Kumar and Dalgobind, (2013) evaluated the performance of forecasting methods using the accuracy of Mean Average Deviation (MAD), Mean Squared Error (MSE) but in different industry and location. The review of the above literature indicated that there are no best overall accuracy measures which can be used as a universally accepted single metric for evaluating and choosing the appropriate forecasting method

Materials and Methods

This study adopted a survey and ex post facto descriptive designs which involved the conduct of pilot study, interview and the collection of secondary data of the sales record of the selected retail pharmacy outlet that sell both wholesale and retail products to customers. A combination of quantitative forecasting techniques of; (i) a moving average method; (ii) a simple exponential smoothing method and (iii) least square method were applied to generate demand forecasts for 12 months from January, 2018 to December, 2018 from Twelve (12) historical monthly sales figures from January, 2017 to December, 2017. The demand forecasts were subjected to accuracy test to identify errors made. The forecasting errors challenge the overall accuracy of the forecasting methods no matter how simple or sophisticated.

Data Presentation

Twelve (12) historical monthly sales figures from January, 2017 to December, 2017 were collected from the sales records of the chosen retail Pharmacy as presented in table 1. The three forecasting methods (moving averages, smoothing constant and least cost method) were used to determine sales forecasts from January, 2018 to December, 2018. The performance of the forecasting methods was evaluated with forecast accuracy measures (MAD, MAPE and MSE).

Table 1. 12 month's sales figures of Pharmacy

Month (x)	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Actual sales (y)(million)	25	29	28	35	32	36	41	45	20	23	15	

Source: Company's Sales Records

Results and Discussion

Sales Forecast using 2-Month Moving Average Method

The study used 2-month moving average method to be able to even out the peak and valley in the sales figures for two months which tends to generate better forecast as indicated in table 2. Also, the accuracy of the forecasting method was evaluated as represented in table 2.

Table 2. Actual and Forecasts using 2-Month Moving Average Method

Month (x)	**Actual sales (y) (million)**	Forecast	IEI	IEI^2	E/Y x100
1	25	-	-	-	
2	29	-	-	-	
3	28	24.5	3.5	12.25	12.5
4	35	28.5	6.5	42.25	18.57
5	33	31.5	1.5	2.25	4.55

6	32	34	2	4	6.25
7	36	32.5	3.5	12.25	9.72
8	41	34	7	49	17.07
9	45	38,5	6.5	42.25	14.44
10	20	43	23	529	115
11	23	32.5	9.5	90.25	41.30
12	15	21.5	6.5	12.25	43.33

The forecast accuracy performance measures are;

MAD =Σ/E//T= 69.5/12 = 5.79, MSE =Σ/E/^{2}T = 795.75/12 = 66.31

MAPE = (Absolute error / Actual Observed Value) × 1 00 = 282.73/12= 23.56.

Sales Forecast using Exponential Smoothing Method

This is an advance method, weighted average method which overcomes the limitations of moving averages. In this study, α is assumed to 0.30 (30%). This implies that that 30% of the forecast will be affected by recent data while the while the older data will be affected by 70%. It is similar to the value of smoothing constant (α) applied in (Rakesh & Mahto's, 2013) study of evaluating the performance of forecasting methods to determine the level of accuracy.

Table 3. Actual and Forecasts using Exponential Smoothing

	Actual sales (y) (million)	Forecast	IEI	IEI^2	|E|/Y x100
1	25				
2	29	25	4	16	13.79
3	28	25.9	2.1	4.41	7.5
4	35	28.56	6.44	41.47	18.4
5	33	29.89	3.11	9.67	9.42
6	32	30.52	1.48	2.19	4.63
7	36	32.17	3.83	14.67	10.64
8	41	34.82	6.18	38.19	15.07
9	45	37.87	7.13	50.84	15.84
10	20	36.26	16.26	264.39	81.3
11	23	24.14	1.14	1.30	5.65
12	15	21.40	6.4	40.96	42.67

The forecast accuracy performance measures are;

MAD =Σ/E//T= 58.07/12 = 4.84, MSE =Σ/E/^{2}T = 484.09/12 = 40.34

MAPE = (Absolute error / Actual Observed Value) × 1 00 = 224.91/12= 18.74

Least Square Regression Model

Table 4. Actual and Forecasts using Least Squared Model

Month (x)	**Actual sales (y) (million)**	XY	X^2	Forecast	IEI	IEI^2	|E|/Y x100
1	25	25	1	32.92	7.92	62.73	31.68
2	29	58	4	32.42	3.42	11.70	11.79

3	28	84	9	31.92	3.92	15.37	14
4	35	140	16	31.42	3.58	12.82	10.23
5	33	165	25	30.92	2.18	4.75	6.61
6	32	192	36	30.42	1.58	2.50	4.94
7	36	252	49	29.92	6.08	36.97	16,89
8	41	328	64	29.42	11.58	134.10	28.24
9	45	405	81	28.92	16.08	258.57	35.73
10	20	200	100	28.42	18.42	339.30	92.1
11	23	253	121	27.92	4.92	24.21	21.39
12	15	180	144	27.42	12.42	154.25	82.8

78 362 2282 650

a= 33.42 b= -0.5

Therefore the regression line equation for forecast is F =

y = 33.42 + (-.5)X and (X=1=12) to generate the forecast for the 12 months.

The forecast accuracy performance measures are;

MAD =Σ/E//T= 92.1/12 = 7.675 = 7.68, MSE =Σ/E/$^{2/}$T = 1057.27/12 = 88.11

MAPE = (Absolute error / Actual Observed Value) × 1 00 = 356.4/12 = 29.7

Table 5. Summary of the results of the Forecast Accuracy Measures

Measure of Accuracy	Moving Average Method	Exponential Smoothing Method	Least Cost Method
MAD	5.79	4.84	7.68
MSE	66.31	40.34	88.11
MAPE (%)	23.56	18.74	29.7

Table 5 reveals that the values of MAD, MSE and MAPE under moving average method are 5.79, 66.31 and 23.56% respectively. For exponential smoothing method, the values of MAD, MSE and MAPE are 4.84, 40.34 and 18.74%, respectively. While the value of MAD is 7.68, MSE is 88.11 and MAPE is 29.7% under least cost method. In performance accuracy comparison, it was observed that exponential smoothing method is the best technique because it generates the optimal forecast accuracy. That is, exponential smoothing method having the least values of MAD (4,84), MSE (40.34) and 18.74 (%) indicates that it has least error and more accurate forecast than the other two methods. Therefore, the pharmacy is advised to consider the exponential smoothing method for accurate demand forecasting.

Conclusion

Demand forecast of a retail pharmacy with high stock level and customer orders like most retail outlets such supermarkets and restaurant with comprehensive historical data can be determined using other statistical forecasting method(s) rather than relying on the use of naïve forecasting or qualitative forecasting methods owing to

lack of proper sales records and the understanding of the importance of scientific forecasting methods. It also evaluated the performance of the forecasting methods (moving average method, exponential smoothing and least square method) in terms of accuracy of sales forecasts using MAD, MSE and MAPE. The findings reveal that using Exponential Smoothing Method generates lowest forecast error, hence more accurate forecasts than other methods. However, the results may not necessarily be the same if a higher or lower smoothing constant (α) is assumed. Also, the usefulness of the statistical forecasting techniques depends on the availability and quality of the historical data which is a function of number and competency of workers, relevant equipment, inventory system (automated) and leadership commitment. It is pertinent to know that there is no method which could be considered as the best one among the others, although Exponential Smoothing Method is the best method that forecasts our data with the least error.

Although, this study is not without some limitations; first, the study used the most common forecasting methods ignoring the complex and sophistication methods. Second, the smoothing constant (α) of 30% (.30) may not be applicable in all retail pharmacy stores especially with different size or operate in another location. Different companies or industries may require another method(s) of forecasting. Also, data were obtained from pharmacy on the assumption that the sale figures were properly records. These limitations notwithstanding have no effect on the reliability and validity of the demand forecast and its accuracy. Therefore, it is recommended that retain pharmacy should maintain sound sales and inventory records; it becomes easier if the system can be computerized but it could be expensive to operate. Also, the operators should determine demand forecast by scientific (quantitative) forecasting techniques that use hard data instead of qualitative forecasting techniques that rely on soft information such as personal experience, intuition, values and opinions

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Intellectual Property Rights and Economic Growth in Selected Africa Countries

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Abstract: The productive behaviour of some selected Africa countries is investigated through protection of intellectual property rights. The study makes use of secondary data spanning within 1995 and 2015 and used dynamic panel GMM technique to analyse the data. It was observed that in the selected countries, protection of intellectual property right had a negative impact on economic growth in the selected countries. The implication of this is that, developing countries must seek ways of protecting intellectual property assets without compromising their objective of industrial growth and development.

Keywords: Intellectual property rights; Economic growth; Dynamic panel GMM

JEL Classifications: C5; I23; I25; O43

1. Introduction

The impact of intellectual property rights (henceforth IPR) in influencing scientific research, inventions, productivity and hence economic growth has attracted the interests of academics, researchers, policymakers, government and international organizations in the last two centuries (Jefferson, 1807; Rodrik, 2000; Mingaleva & Mirskikh, 2013; ICC, 2015). Intellectual Property rights enable individuals, corporate organizations and inventors enjoy flow of revenues through the enforcement of monopoly powers from their innovations and intellectual properties. These involve copyrights, Trademarks, Trade Secrets, Patents, Innovations and Inventions (Jefferson, 1807; Rodrik, 2000; Mingaleva & Mirskikh, 2013).

The debates on the use of IPRs has taken another dimension in the context of developing countries, it has been argued that the protection of IPR might have negative effect on the growth of developing countries. This school of thought argued that the per capita income in developing countries is very low and hence the population is unable to afford the purchase of inventions, technology, copyrights, patents, trademarks and innovations that are very expedient for technological

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diffusion, increased productivity which facilitates economic growth among these countries. Hence, it is advocated by this school of thought that the IPR should not be protected among these countries.

On the other hand, another school of thought has emerged arguing against the weak protection of IPR among developing countries. According to this school, IPR, if properly managed and protected could become a veritable source of sustainable revenue as witnessed among knowledge-driven economies like US, UK, Japan, Germany among others (Raymond, 1996; ICC, 2015). For instance, Intellectual Property industries generated 17% of the GDP of the USA in 2003 (Economic Reports of the President, 2004) while ten of the industries in this sector generated over 8% of the UK's GDP and 36.7% of the industrial output (Raymond, 1998; ICC, 2015). These economies have relinquished most of their primary production activities to the developing countries like China and African countries while relying on copyright, patents, royalties on their innovations and inventions for generating and yielding huge revenue which is made possible by the availability of the effective and efficient intellectual property rights protection.

Since the IPR was enacted by the World Trade Organization (WTO) in 1994, the relationship between IPR's protection and economic growth has attracted an unending argument among researchers. However, there has not been consensus on the impact of protection of property rights in attracting inventions, productivity and economic growth among researchers. In developed countries, Studies have reported negative relationship.(for example, Glaeser et al., 2004; Fogel, 2004; McArthur & Sachs, 2001; Schmid, 2006; Falvey et al., 2006; Sakakibara & Branstetter, 2001; Thompson & Rushing, 1999; Angeles, 2011; Azevedo, Afonso & Silva, 2013; Ofili, 2014; Lewer & Saenz, 2015). These studies reported that tight protection of property rights would hinder imitation which is a significant source of technological development and thus slow down economic growth. On the other hand, studies like: Gruben (1996); Kanwar and Evensong (2003); Daley, 2014; DFID, 2014; Haydaroglu (2015); Nwabachili & Nwabachili(2015) argued that strengthening property rights leads to a significant positive effect on generating innovation, inventions and consequently economic growth among countries.

Though, the debate on IPR and economic growth started among African developing countries after the enforcement of the IPR by the WTO in 2005. Empirical evidences from developing countries have been very scarce. To the best of our knowledge, the only existing studies on the subject among African countries are: Sakakibara & Branstetter (2001); Kanwar and Evenson (2003); Ofili, (2014) and Nwabachili & Nwabachili (2015) which reported mixed results. In addition, these studies are conducted on individual countries while most are not empirical (Kanwar & Evenson, 2003; Nwabachili & Nwabachili, 2015). Furthermore, existing studies in advanced countries have employed static panel models using fixed and random effects thereby

neglecting the impacts of persistence in economic growth in modelling the relationship. These issues are therefore addressed in this study.

Unlike existing studies on African countries, this study employs a panel dataset using a panel of thirty-six African countries to investigate the relationship between property right protection and economic growth, to the best of our knowledge being the first study to employ panel method among studies on developing countries and African countries in particular. The study adopts the panel data analysis method due to the inconsistency in the use of OLS as an estimator of the growth regression. The problems of OLS as an estimator are highlighted to include; first, the regression disturbance term may include some unobserved country effects that may be correlated with the regressors employed. Second, some of the regressors may be correlated with shocks that affect income per capita. Also, there is possibility of simultaneity biases resulting from the endogeneity of some growth determinants such as property rights. To overcome these econometric problems, we employed the fixed effects (FE) and random effects (RE) estimators. In this study, we report and compare results obtained from these estimators and we also conduct some diagnostic tests to complement the estimation techniques.

The rest of the paper is arranged as follows. Section 2 provides the literature review. Section 3 discusses the Data sources and Methodology. Section 4 presents the results and discussion. Section 5 contains the conclusion and recommendations from the findings.

2. Literature Review

In the growth literature it has been identified that secure property rights is one of the key reasons why some countries are so rich while some are so poor. Countries that are able to ensure secure property rights grow faster while countries that lack secure property rights grow slowly (McArthur& Sachs, 2001). Property rights internalize costs and benefits and provide the proper incentives for good stewardship of resources.

Economists have identified at least four ways that insecure property rights negatively affect economic activities. Besley and Ghatak (2009) have recently summarized these four aspects. First, insecure or weakly enforced property rights increase the risk of expropriation, which diminishes incentives to invest and to produce. Second, insecure property rights decrease productivity by necessitating the need to defend property. Third, insecure property rights fail to facilitate gains from trade (i.e., if property rights are not full or entirely secure, assets sometimes cannot be transferred to those who can use them most productively). Finally, property right serves as an important tool in supporting other transactions such as obtaining financing via its role as collateral (Besley & Ghatak, 2009).

In the modern literature on economic growth, technological progress is viewed as the prime determinant of long-run growth. This technological progress arises from the activities of economic agents carried out in order to profit from the introduction of new products (Romer, 1990) or the improvement of existing ones (Aghion & Howitt, 1992). Agents invest in research and development in the expectation of making profit from the inventions. But besides creating new products, innovative activity adds to society's stock of knowledge, upon which subsequent innovations are based. This process is assisted where potential inventors has the information that property rights are protected.

However, there is no consensus in the literature about the exact impact of protection of property rights on incentive to invest in particular, and growth in general. According to Leger (2006), by giving temporary exclusive rights on inventors, the right-holders will price their products above marginal cost, and hence recover their initial research investment. Such right creates motivation for the conduct of research and development, which contributes to the promotion of technological innovation and to the transfer and dissemination of technology, in a manner conducive to social and economic welfare. Conversely, Kanwar (2006) claimed that strengthening intellectual property rights (IPRs) could lead to greater innovation in developed countries, which in turn, could be helpful for developing countries.

Stign and Laeven (2002) argued that the existence of an environment with poorly developed financial systems and weak property rights have two effects on firms: first, it reduces the access of firms to external financing; and, second, it leads firms to allocate resources in a suboptimal way. They investigate the importance of property rights for firm growth by studying its impact on firms' allocation of investable resources. They show that the effect of insecure property rights on the asset mix of firms, the asset allocation effect, is economically as important as the lack of financing effect as it impedes the growth of firms to the same quantitative magnitude. Furthermore, the asset allocation effect seems to be particularly important in hindering the growth of new firms. While they use the ratio of tangibles and intangible assets as a measure of asset mix, the implications of their results likely go beyond this particular asset choice and indicate that an efficient allocation of firm resources can be more generally impeded by weak property rights. Their results suggest that the degree to which firms allocate resources in an optimal way will depend on the strength of a country's property rights and that the allocation effect is an important channel in explaining the effect of property rights on firm growth. Thus, their results have the important policy implication that, equally important as the establishment of a good financial system, requiring in turn a functioning legal system, is assuring the protection of returns to different type of assets. To the extent that the emergence of the "new economy" has increased the economic returns to assets on which yields are more difficult to secure, then their results would even underestimate the overall costs of weak property rights. If indeed new economy

assets and future growth opportunities are more related to intangible assets, then any under allocation of investable resources towards intangible assets is likely to impede the future growth of firms and the economies. However, these submissions had been empirically validated over the years by different scholars.

Empirically, in the institutional economics literature, for example, North (1990) suggested that investment in particular types of assets will be higher if there is more protection of property rights of the assets. Besley (1995) showed the role of property rights for investment incentives and provides evidence of the importance of property rights in the context of land ownership by farmers in Ghana. Johnson, McMillan and Woodruff (2002) showed for a sample of firms in post-communist countries that weaker property rights discourage the reinvestment of firm earnings, even when bank loans are available suggesting that secure property rights are both a necessary and sufficient condition for entrepreneurial investment.

The role of property rights in affecting investment patterns has also been acknowledged, although less explicitly studied. Mansfield (1995) hinted that there may be a relationship between protection of property rights and the allocation of investable resources between fixed and intangible assets. Using a survey of firm managers, he states that "most of the firms we contacted seemed to regard intellectual property rights protection to be an important factor" … "[influencing] investment decisions". Stern, Porter and Furman (2000) showed how the strength of a country's intellectual property rights affects its innovative capacity, by measuring the degree of international patenting. In developing countries, the lower degree of investment in intangible assets may relate to the weaker protection of property rights.

Gould and Gruben (1996) employed RRI to examine the importance of stronger IPR protection for growth in a sample of up to 95 countries with data averaged over the period 1960-1988. They also examined whether the impact of IPR protection on growth depends upon the degree of openness to trade. The underlying argument being that in closed economies, stronger IPR protection may not have the desired effect of encouraging innovation and higher growth, as firms may not have the incentive to innovate if their market is guaranteed. The model of Rivera-Batiz and Romer (1991) provided a theoretical rationale for this hypothesis, with firms in closed economies finding it more profitable to copy foreign technology than develop new technology. Both of these indices are based primarily on the statutes themselves, but not on their enforcement or implementation. Consequently, these indices may overestimate the level of protection in a country where strong anti-infringement laws exist, but are not enforced as may be the case in many developing countries that inherited IPR laws from their colonial powers, but do not have the administrative capacity or inclination to enforce them (Gould & Gruben, 1996).

The index or measures of IPRs are included as a variable in a regression model that usually employs panel regression for studies that focus on more than one country

while method like ordinary least square and seemingly unrelated regression have been used as well. Kanwar and Evenson (2003) estimated a panel model for up to 32 countries between 1981 and 1990; Thompson and Rushing (1999) employed a simultaneous equation model to estimate the impact of IPRs on economic growth; Moore (2007) looked at the impact of intellectual property rights (IPRs) on economic growth for a cross-section of 34 Sub-Saharan (SSA) using three different estimation techniques of Ordinary Least Squares, seemingly unrelated regressions, and Fixed effects panel method.

However, studies that focus on optimal level of policy variables have employed threshold regression. Thompson and Rushing (1996) employed threshold regression techniques and regress the average growth of real GDP per capita between 1970 and 1985 on the ratio of investment to GDP, the secondary school enrolment ratio, population growth, initial GDP per capita and the RRI for 112 countries. Thompson and Rushing (1999) extended the work of Thompson and Rushing (1996) to a system of three equations. The three dependent variables are: the growth rate of real GDP per capita, the ratio of total factor productivity (TFP) in 1971 to that in 1990 and the RRI. The system is estimated using Seemingly Unrelated Regression (SUR) techniques for 55 developed and developing countries. Falvey, Foster and Greenaway (2004) extend and update the single equation analysis by employing the recently developed threshold techniques of Hansen (1996, 1999 and 2000). These allow the positioning and significance of a threshold to be identified, as well as the possibility of having more than one threshold. They use the GPI and a panel of up to 80 countries with data averaged over four five-year periods between 1975 and 1994. However, the result does not change from Thompson and Rushing (1996).

Rod, Neil and David (2006) investigated the impact of IPR protection on economic growth in a panel of 79 countries using threshold regression analysis. They show that whilst the effect of IPR protection on growth depends upon the level of development, it is positively and significantly related to growth for low- and high-income countries, but not for middle-income countries. This suggests that, although IPR protection encourages innovation in high-income countries, and technology flows to low-income countries, middle-income countries may have offsetting losses from reduced scope for imitation.

Gould and Gruben (1996) estimated a growth model on a cross-section of up to 95 countries with data averaged over the period 1960–88, including in their regression the IPR measure of Rapp and Rozek (1990). They find that IPR protection has a significant positive impact on growth. Thompson and Rushing (1996) estimated cross-section growth regressions including up to 112 countries for the period 1970–85, again using the Rapp and Rozek measure. While they find positive coefficients on the IPR variable, they are never significant. Both of these studies also considered non-linearities in the relationship. Gould and Gruben (1996) examine whether IPR

protection affects growth in open versus closed economies differently, by interacting their measure of IPRs with three measures of a country's trade orientation. Their results suggested that

IPR protection can have a slightly larger impact on open economies, but only for one measure is the coefficient ever significant and even then its significance is not robust to the inclusion of other variables.

Thompson and Rushing (1996) employed a switching regression model to examine whether increased IPR protection is more beneficial once a country has reached a particular level of development, as measured by initial GDP per capita. Their results indicated a break point at an initial level of GDP of $3400 (1980 dollars). For countries below this no relationship is found, but above it a positive and significant relationship is reported. They only test for the presence of a single break, however, which may give misleading results if more than one break is present.

Using a sample of ten countries in the post-TRIPS era, Daley (2014) examined the impact of national IPR level on FDI and imports. The empirical findings analysis revealed a positive relationship between intellectual property rights protection on FDI and imports. According to the study, on average, the results show that a one-point increase in the IPR score (about 10 percent) will increase a country's FDI by $1.5 billion (50 percent of the mean amount) and imports by $8.9 billion (40 percent of the mean amount). (Lesser 19) As a result, countries, should consider this positive relationship when devising IPR policy. Similarly, Haydaroglu (2015) investigated the relationship among OECD and EU countries and introduced institutional quality into the debates between 2007 and 2014 using ARDL, the empirical result showed that there is positive relationship between protection of property right and economic growth among these countries. The study further documented that institutional quality plays important roles if intellectual property rights is going to have positive effect on economic growth especially among the developing countries that exhibit weak institutions. Other studies supporting positive relationship includes: Locke, 2013; DFID, 2014; Nwabachili and Nwabachili (2015).

However, Azevedo, Afonso and Silva (2013) documented a negative relationship between intellectual property rights and economic growth, using a North-South general equilibrium endogenous growth model that emphasizes the IPR enforcement effects on growth, in a scenario of North-South technological knowledge diffusion, the study reported that in steady state, the increases in IPR protection result in decreases in the growth rate. In the same view, Ofili (2014) documented a negative relationship on the debates in Nigeria. The study reported that IPRs protection has negative and insignificant relationship with the rate of innovation in developing countries.

In conclusion, the empirical review showed that the empirical studies on the relationship between intellectual rights protection is advanced in the developed

countries while empirical evidences on the developing countries and in Africa is scarce. Still, the existing few studies are individual-country specific though these countries exhibit similar characteristics in per capita income level, ideology, political institutions and economic performance, hence, there is need for a study like this for robustness.

3. Model Specification

Following Mankiw, Romer and Weil (1992), Islam (1995), Caselli, Esquivel and Lefort (1996) and Hoeffler (2000), technological progress g and depreciation δ rate are assumed to be constant across countries and that they sum to 0.05. Therefore, the sum of population growth and 0.05 gives values for $(n + g + \delta)$. Finally, the index of property rights of the heritage foundation is used as measure for property rights.

The study followed the advanced model of Solow (1956) by Mankiw, Romer and Weil (1992). Solow's model takes the rates of savings, population growth and technological progress as exogenous. The production function has two inputs, capital and labour, which are paid their marginal product. Assuming a Cobb-Douglas version of this production function, hence production at time t can be specified as:

$$Y_{(t)} = K_{(t)}^{\alpha}\left(A_{(t)}L_{(t)}\right)^{1-\alpha} \qquad 0 < \alpha < 1 \qquad (1)$$

Where $Y_{(t)}$ is output at time t, K is physical capital, L is labour and A is level of technology, while AL is effective labour. Human capital can be introduced into equation to obtain the augmented Solow model specified by Mankiw, Romer and Weil (1992), such as:

$$Y_{(t)} = K_{(t)}^{\alpha}H_{(t)}^{\beta}\left(A_{(t)}L_{(t)}\right)^{1-\alpha-\beta} \quad 0 < \alpha + \beta < 1 \qquad (2)$$

Where H is the stock of human capital and other variables are as defined above. It is assumed that A and L grow exogenously at rates:

$$L_{(t)} = L_{(0)}e^{nt} \qquad (3)$$

$$A_{(t)} = A_{(0)}e^{gt} \qquad (4)$$

Therefore, the units of effective labour $A_{(t)}L_{(t)}$ grows at rate $n + g$.

Output per effective labour is expressed as $y = {}^{Y}/_{AL}$, physical capital per effective labour $k = {}^{K}/_{AL}$, and human capital per effective labour $h = {}^{H}/_{AL}$. It further assumed that certain fractions of output are invested in physical and human capital respectively. Let these fractions be s_k and s_h for investments in physical capital and human capital respectively. Thus, the evolutions of the two capitals per effective labour are expressed as:

$$\dot{k}_{(0)} = s_k y_{(t)} - (n + g + \delta)k_{(t)} \qquad (5)$$

$$\dot{h}_{(0)} = s_h y_{(t)} - (n + g + \delta)h_{(t)} \qquad (6)$$

Where δ is depreciation and other variables are as defined above. According to the theory, equations (5) and (6) are expected to converge to the steady-state levels of capitals that can be expressed as:

$$k^* = \left(s_k^{1-\beta} s_h^{\beta} \Big/ n + g + \delta\right)^{1/1-\alpha-\beta} \qquad ----(7)$$

$$h^* = \left(s_k^{\alpha} s_h^{1-\alpha} \Big/ n + g + \delta\right)^{1/1-\alpha-\beta} \qquad ----(8)$$

Substituting equations (7) and (8) into output per effective labour and taking the logs will yield:

$$\ln(y) = \ln A_{(0)} + gt - \frac{\alpha+\beta}{1-\alpha-\beta}\ln(n+g+\delta) + \frac{\alpha}{1-\alpha-\beta}\ln(s_k) + \frac{\beta}{1-\alpha-\beta}\ln(s_h) --- (9)$$

Equation (9) shows that output per capita is negatively related to population growth, positively related to physical capital and human capital.

The empirical model for this study follows from equation (9), the equilibrium augmented Solow model. The term $\ln A_{(0)}$ reflect not just technology but also include things like resource endowments, climatic conditions, institutions, and so on, hence, these may differ across countries. Therefore, it is assumed that $\ln A_{(0)} = \alpha + \varepsilon$, where α is a constant and ε is a country specific shock. Thus, the empirical model can be written as:

$$\ln(y) = \alpha + gt - \gamma \ln(n + g + \delta) + \pi \ln(s_k) + \mu \ln(s_h) + \varepsilon \qquad (10)$$

Explicitly, $= \frac{\alpha+\beta}{1-\alpha-\beta}$, $= \frac{\alpha}{1-\alpha-\beta}$, and $\mu = \frac{\beta}{1-\alpha-\beta}$.

It is assumed that the rates of saving and population growth (s and n) are independent of the country specific factor ε. The panel data model from equation (10) is therefore specified as:

$$lny_{it} = \alpha_i + \theta_t + \beta_1 lnsk_{it} + \beta_2 lnsh_{it} + \beta_3 ln(n_{it} + g + \delta) + \varepsilon_{it} \qquad (11)$$

Where $\alpha_i$is time invariant effect unique to each country i, θ_t is time effect common to all countries in period t, and ε_{it} is individual time varying error distributed independently across individuals and independently of all α_i and θ_t. Equation (11) is the baseline model.

To test the impact of property rights on growth, a variable measuring property rights is introduced to equation (11), specified as:

$$lny_{it} = \alpha_i + \theta_t + \beta_1 lnsk_{it} + \beta_2 ln\mathrm{sh}_{it} + \beta_3 ln(n_{it} + g + \delta) + \beta_4 ln\mathrm{propr}_{it} + \varepsilon_{it} \quad (12)$$

To be able to test the convergence of hypothesis, the lag of the dependent variable is introduced as explanatory variable in the model. Hence, the dynamic version of the baseline model and the property rights augmented model are specified as:

$$lny_{it} = \alpha_i + \theta_t + lny_{it-1} + \beta_1 lnsk_{it} + \beta_2 ln\mathrm{sh}_{it} + \beta_3 ln(n_{it} + g + \delta) + \varepsilon_{it} \quad (13)$$

$$lny_{it} = \alpha_i + \theta_t + lny_{it-1} + \beta_1 lnsk_{it} + \beta_2 ln\mathrm{sh}_{it} + \beta_3 ln(n_{it} + g + \delta) + \beta_4 ln\mathrm{propr}_{it} + \varepsilon_{it} \text{------(14)}$$

This study employs different estimation methods, the static models equations (11) and (12) are estimated using the OLS, fixed effect and random effect estimators. The OLS estimator is consistent only when ε is not related to the α and θ.

Data for the empirical analysis in this study cover the period 1995 to 2015 for thirty-six countries in Africa. Though studies on growth are divided between using per worker values or per capita values of variables, per capita values are used in this study. Thus, real GDP per capita which is obtained from Pen World Table 7.0 is used for y. Investment as share of GDP is used for $\mathrm{sk_{it}}$ and is obtained from Pen World Table 7.0. Gross secondary school enrolment is used to proxy $\mathrm{sh_{it}}$ and is obtained from Africa Development Indicator (ADI) 2011.Population growth is calculated using data on population aged 16 to 65 obtained from ADI. We use this age bracket because they constitute the working population (not everyone in the economy contributes to output).

4. Analytical Framework

The study first subject the data to a descriptive test to analyse the behaviour of the data over the years under study. From the result, it was revealed that the mean of capital captured by ratio of fixed capital formation and gross capital product was 21.89%. This means that an African country allocates less than 30% to investment. The mean falls within the minimum and maximum values of 2.78% and 60.16% respectivelly showing that the series display a great consistency. Similarly, the standard deviation of 8.2551 shows that African countries are very different in terms of investment. Also, the skewness shows that the series is normally skewed. The result is presented in table 4.1 below.

Table 4.1. Descriptive Statistics of the Variables

	LCOMP	CAPTAL	LABOUR	RGDPCP	PROPRG
Mean	5.122176	21.88479	2977454.	5236.493	39.65615
Maximum	34.23577	60.15617	59123433	330324.4	75.00000
Minimum	-16.49508	2.781138	11384.00	106.0170	10.00000
Std. Dev.	3.773699	8.255097	9062451.	24591.19	14.01247
Skewness	1.213817	1.011501	4.851420	7.707472	0.662975
Jarque-Bera	4557.094	247.8462	16365.35	134817.0	48.23790
Probability	0.000000	0.000000	0.000000	0.000000	0.000000

Source: Researcher, 2017.

The correlation result revealed that all the pairs give coefficients that are less than 0.5 (50%). The two pairs with the highest coefficients are capital (INVESTM) and the aggregation of economic growth, population growth and technological progress which gives the coefficient of 0.2039 (20%). This gives the evidence that the problem of multicollinearity does not arise in this study. The result is presented in table 4.2 below.

Table 4.2. Correlation Matrix of the Variables

	LCOMP	LCAPTAL	LLABOUR	RGDPCP	PROPRG
LCOMP	1.000000				
LCAPTAL	0.203837	1.000000			
LLABOUR	-0.021308	-0.062614	1.000000		
RGDPCP	-0.084924	-0.004754	-0.053485	1.000000	
PROPRG	-0.118748	0.015799	0.052410	0.051469	1.000000

Source: Researcher, 2017.

Panel Unit Root Test

Testing for the stationarity property of the variables has been described as fundamental for using dynamic panel data model (Chang et al., 2011). In view of this, this study adopts panel unit root tests by Levin, Lin and Chu, LLC (2002), Im, Pesaran & Shin or IPS (2001) and PP-Fisher (2001). The difference among the three tests is that while LLC assumes a common unit root process, IPS and PP-Fisher (2001) allow for individual unit root process. The results of all the unit root tests are presented in tables 4.3 and 4.4. While table 4.3 contains the results of the unit root tests with individual effects only, table 4.4 reports the results of the unit root tests with individual effects and linear trend.

As shown in table 4.3, the result shows that the variables of real per capita GDP, investment and intellectual property rights achieve stationarity at first difference based on the principles of Im, Pesaran & Shin's (2003) Wald test, Levin, Lin & Chu's (2002)'s test and Philip, Perron- Fisher's (2001) test which are available for individual effects only. As a result, all the tests reject the null hypothesis that the variables contain unit root process at 1% and 5% levels of significance at first

difference. The results establish that the variables portray the stationarity processes at first differencing (that is, they are all integrated of order one [I(1)]). On the other hand, the variables of labour and the aggregation of economic growth, population growth rate and technological progress are, however, integrated at levels without being differenced. This shows that these variables are integrated of order zero [I(0)]).

In addition, the results of the stationarity model on individual effects and linear trends are reported in table 4.4. This further established the results of the individual effects only as the three variables of real per capita GDP, investment and intellectual property rights are also stationary at first differencing. However, intellectual property rights protection is also stationary at first differencing under this model. Still, only the aggregation of population growth rate, technological progress and economic growth is stationarity at levels without being differencing.

Table 4.3. Result of the Panel Unit root Test (Individual Effect Only)

Variables	LLC	Breitung	IPS	PP-Fisher	ADF-Fisher
LCOMP	-5.82243***	-	-7.89796***	457.402***	194.181***
LCAPTAL	-1.1923	-	0.7238	80.0857	62.4902
ΔLCAPTAL	-12.7438***	-	-12.9897***	1143.18***	308.350***
LLABOUR	-2.64982***	-	2.9888	123.580***	66.4069**
RGDPCP	1.4518	-	6.68338	27.3618	14.7919
ΔRGDPCP	-10.2022***	-	-8.83745***	550.250***	208.946***
PROPRG	0.64491	-	1.47172	48.2341	51.1609
ΔPROPRG	-4.60334***	-	-6.98145***	127.482***	321.766***

Source: Author, 2017

Table 4.4. Result of the Panel Unit Root Test (Individual Effect and Linear Trend)

Variables	LLC	Breitung	IPS	PP-Fisher	ADF-Fisher
LCOMP	-4.63260***	-4.97987***	-6.40618***	166.868***	409.834***
LCAPTAL	-3.16433***	-2.23042**	-1.61114*	100.671**	141.799***
LLABOUR	3.8518	3.80995	1.34206	59.5554	336.714***
Δ LLABOUR	6.43112**	-0.19149	-2.50977***	274.555***	-
RGDPCP	-3.86490***	-2.16719**	-2.30478**	70.5609	89.7466*
ΔRGDPCP	-	-	-	250.109***	143.414***
PROPRG	2.55834	0.50405	0.07338	59.5277	82.3042
ΔPROPRG	-5.49559***	-3.14106***	-5.33816***	125.383***	297.510***

Source: Author, 2017

From the unit root result, having justified that the pooled OLS, fixed effects and random effects models prevalent in the literature are not suitable for the analysis, hence, the suitability of the dynamic model of differenced GMM is accepted in the present study.

The estimation of the effect of intellectual property right on economic growth in Africa is therefore presented in table 4.5. From the result, it was shown that the protection of intellectual property rights in the previous years has significant and positive effect on the current protection of intellectual property rights at 1%. The result shows that 1 percent increase in the protection of intellectual property rights in the previous one year will induce about 88% increase in the protection of intellectual property rights of selected African Countries. This result confirms the fact that previous condition of the protection of intellectual property rights is a major determinant of the present protection of intellectual property rights condition in the economies. Furthermore, it demonstrates the fact that generalized method of moments is robust in investigating the relationship between the protection of intellectual property rights and economic growth among African countries in empirical studies.

The result in table 4.5 showed a negative relationship between the protection of intellectual property rights and economic growth. As shown in table 4.5, the coefficient of protection of intellectual property rights is negative and statistically significant in all the models at 1%. This indicates that a unit increase in the protection of intellectual rights reduces economic growth by 15%. Thus, the empirical results establish a negative relationship between the protection of intellectual property rights and economic growth among African countries. This means that increase in the level of intellectual property rights brings about reduction in economic growth among African countries. This result further established the view of the school that submitted that African countries are too poor to afford the cost of technological products, innovation and services needed for economic growth.

Having discussed empirically the effects of protection of intellectual property rights on economic growth, the control variables are the next. One of the control variables employed in the literature is the skilled labour. The result on table 5 shows that skilled manpower does have a positive and significant influence on economic growth among African countries at 1% level of significance among all the models. This shows that if skilled manpower is increased by 1 percent, economic growth among African countries goes up by 4 percent. This conforms the *a priori* expectation that the higher the development of labour thereby leading to skilled manpower among African countries, the higher the level of economic growth. The result is in conformity with most of the existing studies in the literature (Ofili, 2014; Lewer & Saenz, 2015).

Meanwhile, the coefficient of investment (INVESTMT) is positive and significant at 1% level of significance. The result showed that 1% increase in the gross fixed capital formation will lead to 2% increase in economic growth among African countries. This means that increase in investment among African countries has increased economic growth thereby validating theoretical submission of positive

impact of investment on economic growth. The results also imply that the present drive among African countries to entice foreign direct investment in augmenting local and internal investment is in the right direction.

Lastly, the result of the last control variable employed in the study, the aggregation of population growth, technological progress and economic growth has positive effect on economic growth. This is positive and significant. This means that technological progress has increased the real per capita income among African countries.

Table 4.5. The Effect of Intellectual Property Right on Economic Growth in Africa

	Pool OLS	**Fixed Effects**	**Two-Step Difference GMM**
$LRGDPCP_{it-1}$	-	-	0.8823***
	-	-	-0.0143
LPROPRT	-0.5343***	-0.5465***	-0.1529***
	-0.0684	-0.069	-0.025
LCOMP	0.00297	0.0034	-0.0112***
	-0.0038	-0.0038	-0.00083
LENROL	0.3393***	0.3630***	0.0417***
	-0.0265	-0.0272	-0.005
LINVESTM	0.1991***	0.1757***	0.0186***
	-0.0451	-0.0454	-0.005
Constant	3.6636***	3.3815***	-
	-0.5425	-0.5174	-
Year Dummy	Yes	Yes	Yes
AR(1) test (p-value)	-	-	0.0082
AR(2) test (p-value)	-	-	0.1039
Hansen test of over-identification (p-value)	-	-	0.718
Hausman Test	0.0000	0.0000	-
F-Stat (p-value)	0.0000	0.0000	0.0000
R^2	0.1432	0.9505	-
DW-Statistic	0.0625	1.3261	-

Source: Author (2017)

5. Conclusion and Recommendations

The study investigated the effect of protection of intellectual property rights on economic growth among selected African countries between 1995 and 2015 inclusive using a dynamic panel GMM. The study is motivated by the theoretical controversies between two schools; first, the one that believes protection of intellectual property positively positives affect economic growth as it encourages foreign firms and innovators to bring in innovations, technologies and skilled manpower into African countries since they know that their innovations, skills, copyrights will be protected. The empirical result on the relationship between the protection of intellectual property rights and economic growth reported a negative trend thereby confirming the negative relationship submitted by the descriptive and

graphical analysis. This shows that the treaty enacted by the World Trade Organization in 1995 has yielded negative impacts on the growth of African countries thereby establishing the view of the school that submitted that African countries have low per capita income and hence, inability to purchase the necessary trademarks, innovations, copyrights and technological skills needed for African countries' economic growth. The study concludes that the selected countries in Africa have not enjoyed the benefits of intellectual property right on the growth of their economy over the years under study. The study therefore recommends that the African countries, while complying with the WTO treaty on strengthening IPR to attract investment and growth, they should also not lose sight of the strategies employed by developed countries in their early stage of development when intellectual right protection was weak.

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Savings and Investment Dynamics in South Africa

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Abstract: This paper reviews savings and investment dynamics in South Africa in order to enhance the understanding of savings-investment gap in the country. This is achieved through an analysis of savings and investment trends, policy initiatives implemented and challenges faced. The study finds that saving rates in South Africa have been generally low, while investment rates have been erratic over time. Both variables display a rising trend from 1960 into the 1970s. However, by 2015 the savings rate had decreased significantly, while investment rates were relatively low and erratic when compared to the period between 1964 and 1984. The study recommends that polices that are aimed at strengthening corporate savings, while simultaneously bolstering household and public savings, should be implemented. The study recommends that polices that are likely to boost the cost of capital and returns on investment should be implemented to make the country more attractive to foreign direct investment.

Keywords: private savings; public savings; investment; South Africa

JEL Classification*:* E21; E22

1. Introduction

Both savings and investment are essential for growth (Chakrabarti, 2006; Eyraud, 2009). The impact of these variables on growth has been extensively studied by a number of authors. A number of studies have shown that savings are essential for growth (Amusa & Moyo, 2014; Odhiambo, 2009; Singh, 2009). Similarly, a number of studies have shown that economic growth is also essential for savings (Sinha & Sinha, 2008; Narayan & Narayan, 2006; Agrawal, 2001). In a study of South Africa from 1950-2005, Odhiambo (2009) found a feedback relationship between savings and economic growth in the short run. The Harrod-Domar model and the subsequent model by Solow (1956) and Swan (1956) show that savings are essential for a capital output ratio, linking savings to investment (Sothan, 2014). Savings are also crucial for macroeconomic balance and maintaining financial and price stability (Prinsloo, 1994). Aron and Muellbauer (2000) state that corporate and household savings are inextricably linked to economic growth. They add that it is important to understand

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both personal and corporate saving behaviour in order to formulate policies that raise the domestic saving rate in line with the needs of economic growth. Eyraud (2009) found savings to be crucial for economic growth in South Africa. He links savings to growth and investment, stating that higher savings lead to an increase in investment and, thus, to economic growth. State institutions such as the National Treasury and Statistics South Africa (Stats SA) have also conceded that South Africa's low savings rate is problematic for the economy. Low savings result in low investment and, thus, in low economic growth, ultimately exacerbating unemployment (StatsSA, 2013; National Planning Commission, 2011; National Treasury, 2016a; 2016b).

Likewise, investment is also vital for economic growth. According to the Keynesian school of thought, an increase in investment leads to economic growth.[22] According to Rodrik (2000), investment is crucial for growth and is heavily dependent on savings. Similar to savings, investment is classified according to private and public (government) investment (Salahuddin & Islam, 2008).

Unfortunately, South Africa is heavily dependent on foreign savings and, thus, on foreign investment because domestic savings are low. This weakens the economy, making it more susceptible to international capital shifts (StatsSA, 2013; National Planning Commission, 2011; Prinsloo, 2000). The current study, therefore, intends to promote the understanding of savings and investment dynamics in South Africa. This is achieved through an analysis of savings and investment trends and a discussion of the challenges faced. The current policies that have been implemented to bolster savings and investment in the country are also discussed.

The research approach used in this study is largely exploratory in nature. A descriptive analysis of savings and investment data has been conducted in order to examine savings and investment trends in South Africa. The data used in this study has been obtained from the South African Reserve Bank's Online Statistical Query from 1960-2015. Gross domestic savings to GDP ratio (also termed here as the gross savings ratio) has been used to analyse savings trend. The analysis of savings has been further deepened by decomposing savings into private savings, household savings, and corporate savings. Conversely, gross domestic capital formation has been used as the proxy for investment. The data on nominal investment data (gross domestic capital formation) denoted in Rand and gross domestic capital formation to GDP ratio (investment rate) have also been obtained from the South African Reserve Bank's Online Statistical Query for the period, 1960-2015. As in the case of savings, the investment data has been decomposed into public and private investment. Public investment has been further split into general government investment and public corporation investment.

[22] See (Keynes, 1936).

The rest of the paper is organised as follows: Section 2 discusses the dynamics of savings in South Africa; Section 3 discusses the dynamics of investment in South Africa; and Section 4 concludes the paper.

2. Dynamics of Savings in South Africa

South Africa has been characterised by a low savings rate.[23] After the end of World War II, there was an increase in demand for consumer goods, especially durable consumer goods and depleted industrial and commercial inventories. This led to a decline in private savings that had accrued during the war. As a result, gross domestic savings fell to about 8% of GDP in 1947. There was also a massive deterioration in the country's balance of payments. By 1948, the authorities were forced to engage in contractionary policies such as import controls. These led to a gradual increase in personal savings, resulting in gross savings increasing to about 19% in 1950 (Prinsloo, 2000).

Figure 1 shows gross domestic savings trends in South Africa from 1960 to 2015. Savings is also disaggregated to household savings, private saving and public saving.

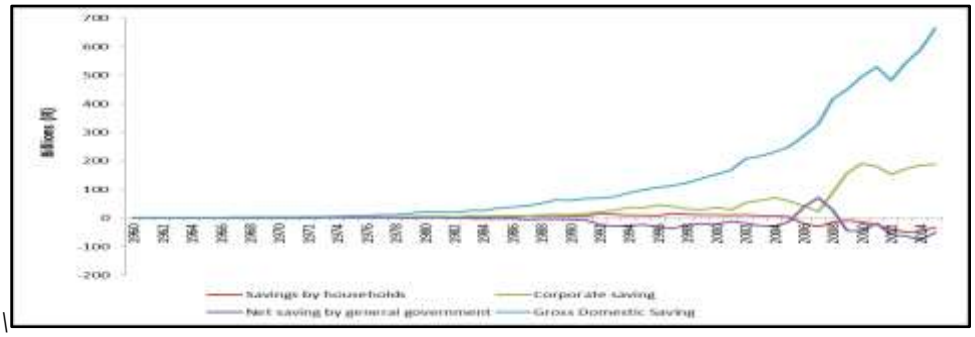

Figure 1. Savings Trend in South Africa (1960-2015)

Source. SARB, 2018. Online Statistical Query

Figure 2 shows savings ratios plotted over time from 1960 to 2015. Plotted on the same graph are South Africa's savings rates for the corporate sector, government, and households, which are significantly lower than the gross savings rate for the country.

[23] See (Aron & Muellbauer, 2000; Prinsloo, 2000).

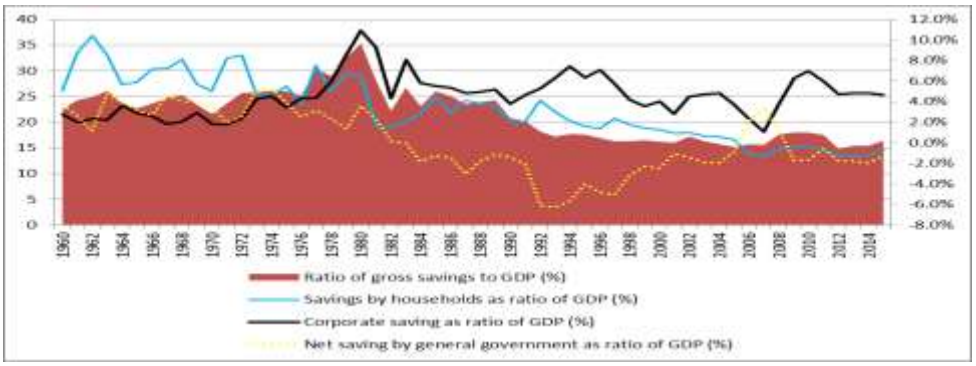

Figure 2. South African Savings Ratios (1960-2015)

Source: SARB, 2018. Online Statistical Query

Gross Savings

Figure 1 shows the gross national savings in Rand between 1960 and 2015. It also depicts that savings by households, corporate sector and net saving by general government. Generally, there has been an increase in gross national savings between 1960 and 2015.In 1960 the gross national savings was R1.2 billion. Gross national savings exceeded R100 billion in 1996. In 2002 gross savings was R209.1 billion. In 2008, gross savings was R417.3 billion. In 2010 it rose to R529.2 billion but plunged to R482.7 billion followed by an increase to R663.9 billion in 2015 (SARB, 2018).

Figure 2, using the primary axis, shows that the gross savings ratio to GDP fluctuated between 14% and 36% between 1960 and 2015. In 1960, the gross savings ratio was 22.5%. The gross domestic ratio peaked over 25% in 1963 (26.1%), 1968(25.3) and rose from 25.7% to 35.3% from 1972 and 1980. 35.3% is the highest gross savings ratio recorded from 1960 to 2015. Generally, between 1960 and 1988, the savings ratio to GDP was over 20%. A marked downward trajectory of the gross savings ratio commenced in 1989. The fall in the gross savings rate was due to the decline in the government savings rate in the early 1980s (Aron and Muellbauer, 2000). The gross savings ratio falls below 20% in 1992 where it was recorded at 18.2%. From 1992 to 2015, the ratio of savings to GDP ranges between 14% and 18%, averaging 16.5%. The lowest gross savings ratio is 14.8% in 2012. In 2015, the savings to GDP ratio was 16.4% (SARB, 2018).

Furthermore, since the 1990s, South Africa's savings to GDP ratio has been low compared with other emerging economies. In 2010, South Africa's gross savings as a percentage of gross domestic product was 16.5%, which is low compared to other emerging economies such as Brazil (18%), Mexico (23.6%), Russia (27.5%), Thailand (31.0%), India (35%), and China (52.4%). From 2001 to 2011, South Africa actually had the lowest level of savings (Duncan, 2012; StatsSA, 2013).

Amusa and Moyo (2014), Eyraud (2009), Prinsloo (2000), National Treasury (2016a) and StatsSA (2013) concur that savings in South Africa are undesirably low. This creates dependency on foreign investment (Aron and Muellbauer, 2000; StatsSA 2013; Erasmus, 2016). Furthermore, Aron and Muellbauer (2000) add that South Africa's low savings rate actually perpetuates a growth trap, since savings are crucial for investment and, ultimately, for economic growth.

Public Savings

Statistical data from the SARB (2017) shows that government (public) savings have declined from R202 million in 1960 to a negative R50.6 billion in 2015. Net savings by general government more than doubled from R202 million in 1960 to R454 million in 1967. It plummeted to R285 million in 1971. Public savings shot up to R1.3 billion in 1974. By 1980, there gross savings reached R2.3 billion, though preceded by much fluctuations. By 1982 public savings amounted R112 billion. These government savings first went sub-zero in 1983 (- R42 million). Since 1983, net government spending was positive for only three consecutive years, 2006-2008, peaking at R72.1 billion in 2007. Though still negative in 2015, public savings is on a rise (SARB, 2018).

In 1960, net government savings as a share of GDP was 3.7%. It peaked to 5.3% in 1974. Net government savings as a share of GDP averaged 3.3% between 1960 and 1980. In 1984, the ratio was negative for the first time at -1.8%, plummeting further to -6.3% in 1993. Since then, there has been an increase in public savings as a share of GDP to -1.24% in 2015 (SARB, 2018).

Household Savings

Household savings data from the South African Reserve Bank Online Statistical Query shows that from 1960 to 1992, the household savings trajectory gently increased, with minor fluctuations. In 1960, household savings was 272 million. It rose to R1.4 billion in 1971, 2.7 billion in 1977, R4.2 billion in 1980; R5.7 billion in 1985 and R15.7 billion in 1992. This was followed by a gradual declined to about R8.9 billion in 1996, which was almost half the 1992 value. In the following year, household savings almost doubled again, reaching R16.6 billion. From 1997 onwards, the level of savings followed a downward trajectory, reaching sub-zero in 2005 (SARB, 2018). In 2013, the savings level hit an all-time low of a negative R48.3 billion. From then on, household savings was on a rising trajectory, though still negative. By 2015, savings were a negative R33.3 billion. A negative savings rate means that consumers are spending more than they have, meaning that they are borrowing more (SARB, 2018).

The household savings to GDP ratio displays a rather volatile but declining trend from 1960 to 1998. The household savings to GDP ratio was 5% in 1960 and only peaked to a record high of 10.4% of GDP in 1962. Since then the household savings

to GDP ratio was on the decline, rising to 8.5%. The ratio then stagnated between zero and one percent from 2001 to 2005. From 2006, the savings to GDP ratio became negative, as was the total savings level. In 2015, the household savings to GDP ratio was again negative at 0.8% (SARB, 2018).

Corporate Savings

Corporate savings display an upward growth trend in South Africa since 1960, as shown in Figure 1. The increase in corporate savings was slow from 1960 to 1990. In 1960 corporate savings were R150 million. In 1977, corporate savings rose to R1.5 billion. In 1996, corporate savings reached R45 billion. From then onwards, there was a slump followed by a rapid increase to R71.7 billion in 2004. Corporate savings then declined sharply to R22.1 billion in 2007, due to the onset of the global financial crisis, but peaked significantly to R89.6 billion the following year. Corporate savings rose further to R191 billion, the highest-ever level, in 2010 but then began to decline. In 2015, corporate savings were recorded at R188.5 billion (SARB, 2018). Corporate savings are the biggest contributor to investment as they are always in the positive compared to the other types of savings (Aron and Muellbauer, 2000).

The ratio of corporate savings to GDP shows great volatility from 1960 to 2015. In 1960, the corporate savings to GDP ratio was 2.8%. The rise in the 1970s was attributed to an increase in the gold price (Aron and Muellbauer, 2000). The highest corporate savings to GDP ratio was in 1980, when it was 10.9%. The lowest ratio ever recorded was 1.0% in 2007. By 2015, the ratio of corporate savings to GDP was 4.7% (SARB, 2018).

However, unlike household savings and net government savings, total corporate savings and its ratio to GDP is always positive and higher than the two former categories of savings. This is consistent with the findings of Aron and Muellbauer (2000) and Prinsloo (2000).

Savings in South Africa endure a number of challenges. The South African Savings Institute (SASI) gives a number of reasons for the low savings rate. One is a lack of profitable investment opportunities. A high cost of capital is another factor negatively impacting savings. A high cost of capital kerbs savings as more would need to be spent to acquire additional capital. A decline in capital costs "… induces additional domestic investment, thus generating simultaneous increases in domestic saving…" (Zodrow, 2010, p. 875). Labour market inflexibility, particularly South Africa's stubborn unemployment rate has led to savings continually being curbed as people are unable to participate in the economy, especially with regard to savings. High corporate taxes reduce corporate savings and similarly high personal taxation reduces disposable income and ultimately lowers household savings (Erasmus, 2016). StatsSA (2013) also adds that inflationary pressures in the country have led to a lower savings. Despite targeting inflation, the inflation rate has risen above the

target range for a number of reasons, especially due to the global financial crisis. In addition, high levels of household debt dampen the ability of households to contribute to overall consumption and savings StatsSA (2013).

Savings Mobilisation Strategies

South African's policy framework identifies the importance of encouraging savings in order to realise economic growth. The increase in economic growth is usually linked to an increase in employment opportunities and a reduction in unemployment (StatsSA, 2013; National Treasury, 2016a). The Reconstruction and Development Programme (RDP) of 1994, initiated by the African National Congress (ANC), prioritised bolstering savings[24]. It spoke to the need for the democratic government to modify regulations and support innovative financial institutions and instruments that mobilised private domestic savings to help fund the RDP, without reducing incentives for personal savings (ANC, 1994). Not much ground was covered in terms of modifying regulations and enticing the private sector to assist with social investments. Another goal related to savings was for government to embark on a review of financial institution legislation, regulation, and supervision to ensure the protection of pension and provident funds and other forms of savings and investment (ANC, 1994). Again, not much was done in this regard. The RDP failed to achieve a number of outcomes, particularly the boosting of savings in the country (Ngubane, 2005; Visser, 2004; Corder, 1997).

The National Development Plan of 2011 (NDP), for instance, highlights the low overall savings rate as a key contributor to South Africa's reliance on volatile, foreign investment flows. This, in turn, causes volatility in the domestic market, affecting low-income households who are most vulnerable. The NDP also points to the need to raise savings to ensure better growth over the medium to long term. As a means for enhancing social protection, the NDP identifies the need to establish "…*a comprehensive system of social protection that includes social security grants, mandatory retirement savings, risk benefits (such as unemployment, death and disability benefits) and voluntary retirement savings* …" by 2030 (National Planning Commission, 2011, p. 53). According to the NDP, the problem was not only the low savings culture in the country, but also the limited mechanisms and incentives to encourage people to save. The NDP identifies the need for intervention both in the private and public sector. As part of the economic plan, the NDP also identifies the use of the fiscal policy to increase savings and investment and reduce consumption. The goal is to increase savings from about 16% to 25% by 2030 (National Planning Commission, 2011, p. 64).

The NDP also cites a number of interventions that would lead to an improvement in household savings. These include the use of the Unemployment Insurance Fund

[24] http://anc.org.za/content/reconstruction-and-development-programme-introduction-rdp.

(UIF) to help unemployed persons avoid the need to withdraw from their retirement funds. Households would also have to engage in both mandatory and voluntary retirement savings schemes. In addition, the private sector must promote savings by designing simple low-cost schemes for the poor (National Planning Commission, 2011, p. 370). This has been enacted. In order to encourage increased savings, National Treasury explored various savings vehicles and, in 2012, released proposals for potential tax incentives (StatsSA, 2013). In the 2013 National Budget speech, the Minister announced a tax relief of R7 billion in 2013. Such a policy stance leads to an increase in household disposable income that would either increase consumption and/or alternatively, increase savings. The increase in personal savings means more money is made available for borrowing by investors, culminating in increased investment and economic growth (Keynes, 1936). In addition, progressive reforms to the tax treatment of contributions to retirement savings were declared (StatsSA, 2013). This effectively increases retirement savings which are then availed to investors for borrowing by financial service providers (Prinsloo, 1994; 2000). Again this boosts personal savings.

In addition, the Minister announced that tax-preferred savings and investment accounts will be introduced in 2015. By 2016, about 150 000 accounts had been opened, with savings totalling R1 billion. Consequently, amendments to the Income Tax Act were concluded leading to the provision for new tax-free savings accounts legislation that came into effect on 1 March 2015 (National treasury, 2016a and 2016b). The accounts free households from tax on any interest income or dividends earned by the investment, regardless of how long households stay invested. The households also do not have to pay any capital gains tax when withdrawing from their investments (Du Preez, 2015). This Act thus has the direct impact of increasing the propensity of households to save, ultimately impacting investment.

The Minister also announced tax relief for small businesses (National treasury, 2016a and 2016b). The implication of this is an increase in profit margins (Aron and Muellbauer, 2000). Increased profits lead to an increase in investment when the profits are ploughed back into the business, ultimately leading to increased economic growth.

3. Dynamics of Investment in South Africa

The growth in South Africa's investment rate has been sluggish. Investment over the last decade has hindered the achievement of faster growth in South Africa, and the underinvestment is partly explained by limited savings. As a result, investment's contribution to economic growth in the country is low. If domestic savings were to grow, investment would also grow (Eyraud, 2009). The user capital cost has been observed rising trend in the following periods from 1963-1995 (Prinsloo & Smith,

1997). It continued to increase thereafter and only stated declining in steadily in 2007 (Goldman Sachs, 2013). Fedderke (2000) finds that in South Africa, high tax rates and therefore a high user cost of capital leads is a deterrent in investment. Both Eyraud (2009) and Fedderke (2000) concur that another challenge faced in the country is the low returns on investment kerbing investment. These make investment in the country less attractive relative to other countries. More recently, another challenge to investment is the global economic crisis that struck the country between 2007 and 2008. The economic crisis in South Africa was characterised by shrinkage in the economy and an increase in unemployment as companies downscaled. The economy has not yet fully recovered and still experiences stunted growth (National Treasury, 2016a; 2016b). Since economic growth is also a driver of investment, low economic growth ultimately affects investment negatively (National Treasury, 2016a).

Figure 3 shows the investment in South Africa over time, measured by gross capital formation denoted in billions of Rand and also gross capital formation as a percentage of GDP, from 1960 to 2015.

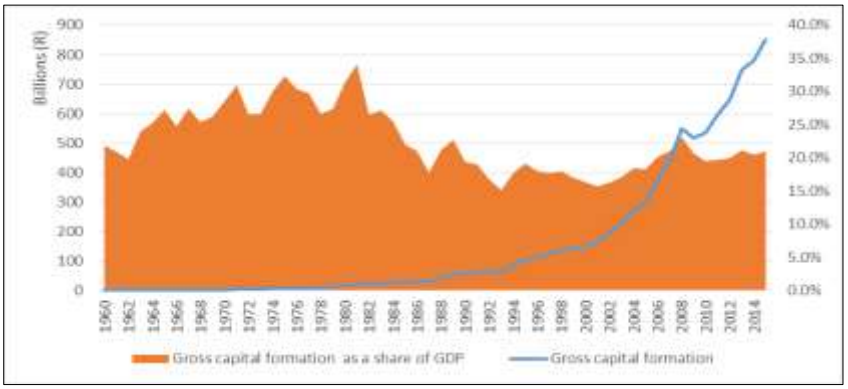

Figure 3. Gross Investment Trends in South Africa (1960-2015)

Source: SARB, 2018. Online Statistical Query

Figure 3 above shows that there has been exponential growth in gross capital formation in the period 1960-2015. Statistical data shows that total gross capital formation rose somewhat exponentially from 1960 to 2015, from R1.2 billion to R850.0 billion (SARB, 2018). In 2008 investment amounted to R548.4 million. It dipped slightly to R519.2 billion but increased steadily since then. In 2012 investment was R649.7 million.

In the period between 1960 and 1986, South Africa experienced the highest levels of investment (over 20% of GDP). This period shows an upward trend though characterised with fluctuations in gross capital as a share of GDP. In 1960, investment was recorded at 21.9% of GDP. It decreased to 19.8% in 1962. It peaked

to 34.1% in 1981, only to decline later to 17.8% in 1986. Thereafter, investment rose above 20% between 1988 and 1989; 2006 and 2009; and also between 2012 and 2015 (SARB, 2018). Between 2001 and 2008, investment increased from 14.8% of GDP in 2001 to 23.2% in 2008. However, from this point onwards, uncertainty resulting from the global financial crisis and slower domestic growth contributed to a sharp drop to 19.5% in 2010. Since then there has been an increase in the gross capital formation to GDP ratio (StatsSA, 2013). From 2012 it has been above 20% and is 21% by 2015.

Figure 4 shows the gross capital formation in millions of Rand from 1960-2015. The gross domestic capital formation is further disaggregated to gross capital formation by the public and private sector. Public sector investment is further disaggregated to investment by general government and public corporations.

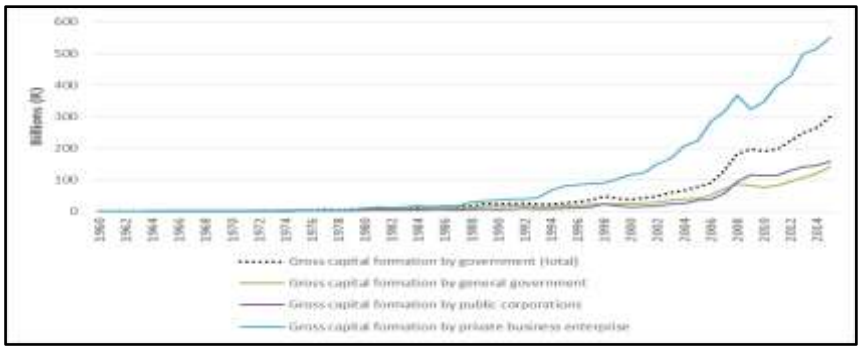

Figure 4. Investment Trends in South Africa 1960-2015

Source: SARB, 2018. Online Statistical Query

Figure 5 shows investment to GDP ratios - the gross capital formation to GDP ratio, gross capital formation by government (total) which is further split into gross capital formation by general government to GDP ratio and public corporations to GDP ratio. Also in Figure 5 is gross capital formation by private business enterprises to GDP ratio.

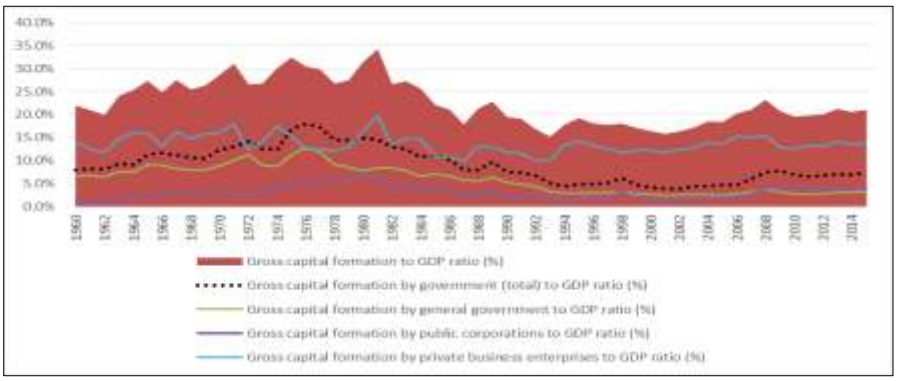

Figure 5. South African Investment Ratios (1960-2015)

Source: SARB, 2018. Online Statistical Query

Private Investment

Figure 4 shows that private business enterprise is the second largest source of investment that also displayed exponential growth, from R756.0 million to R549.9 billion, from 1960 to 2015. Private investment more than doubled the in 1968 to R 1.6 billion from 1960. It exceeded R10 billion in 1980. It grew to R35.4 billion by 1990. In 2000 private investment was over R115 billion and was more than double the value in 2000 to R345.7 billion.

Figure 5 shows that private investment was 14.0% of GDP in 1960. Ten years later it was 16.2% of GDP, and increased to 17.9% of GDP in 1971. It fell to 12.1% of GDP in 1978, but peaked to 19.6% in 1981. This is the highest ever private investment to GDP ratio between 1960 and 2015. The private investment to GDP ratio declined to 13.6% by 2015%.

Public Investment

Figure 4 also shows Total Public or government investment (the sum of gross capital formation by public corporations and general government) also increased over time. It was R428 million in 1960 and exceeded R1 billion in 1966, R10 billion in 1981 and R50 billion in 2003. In 2007 it is recorded at R127.0 billion. In 2015, total public investment was R300.1 billion.

In 1960 the gross capital formation by the public sector was only 7.9% of GDP as shown in Figure 5. In 1966 it was 11.6% of GDP. It peaked to 18.0% in 1976 and subsided to 14.6% by 1981. T continued dropping such that it was below 10% from 1987 to 2015. In 2003 the total public investment was only 4.5% of GDP. Since then there has been an upward trend in the public investment as a share of GDP to 7.4% in 2015.

Public corporation investment

Public corporation investment (Gross capital formation by public corporations) was R68.0 million in 1960 (see Figure 4). It rose to R459.0 million in 1970. It first exceeded a billion Rand in R1.6 billion in 1975. It more than trebled the 1975 value rose to R5.5 billion in 1985. In 1998 it rose to R24.3 billion only to fall to R13.8 billion and bounce back to over R24 billion in 2003. From then onwards there was an upward trend such that investment by public corporations was R1159.1 billion in 2015.

In 1960, investment by public corporations amounted to 1.3% of GDP as shown in Figure 5. This remained below 5% until 1975 where it rose to 5.6% from 3.7% of GDP in the previous year, 1974. Investment by public corporations was above 5% for seven consecutive years (1975-1981), with the highest investment ratio at 7.0% in 1980. From 1983-2015, investment by public corporations was once again below 5%. It declined to 1.4% in 1994, rose to 3.2% in 1998 and back to 1.4% in 2001 and 2002. It rose to 4.6% in 2009 and was 3.9% in 2015.

General government investment

Figure 4 depicts that general government investment was R360 million in 1960. It rose to R10.2 billion in 1986. This more than doubled to 21.8 billion in 1997. General government spending reached R108.0 billion in 2013 and rose further to R141 billion in 2015.

Figure 5 also shows that investment by general government was 6.7 in 2015. It rose steadily to 11.4% in 1972 and 12.8% in 1976. From then onwards there was a steady decline to below 5% for the first time in 1991, it was 4.9% of GDP. It plummeted further to 2.5% in 2001 and 2002, only to rise again. In 2015 investment by general government is recorded at 3.5% of GDP.

Figure 6 shows the composition of investment in the country from 1960-2015

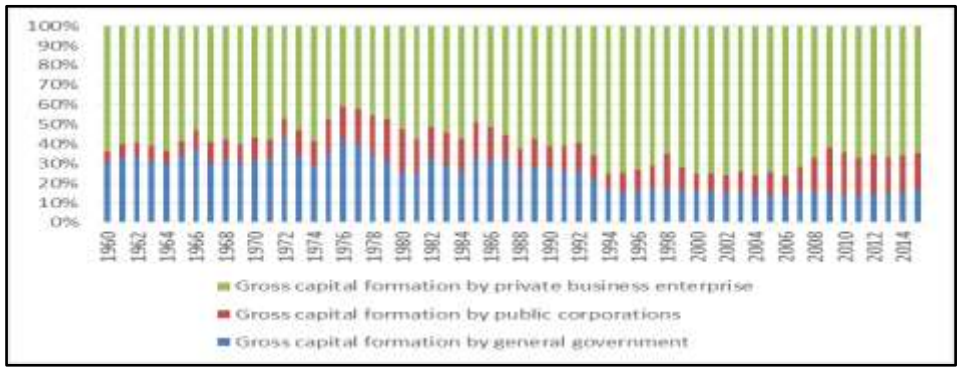

Figure 6. Composition of investment in South Africa

Source: SARB, 2018. Online Statistical Query

Figure 6 shows that the private sector (private business enterprises) is, more often than not, the largest contributor to gross capital formation (investment) between 1960 and 2015. This is true except in a few incidences where the total public sector investment (combination of investment by both public corporations and general government) surpasses private sector government.

In 1960, private investment accounted for 63.9% of total investment, whilst general government and public corporation investment accounted for 30.4% and 5.7% respectively. Between 1966 and 1972, both general government and public corporation investment rose relative to private investment. In 1966, private investment accounted for fell to 53.2% of total investment, whilst general government and public corporation investment accounted for 36.4% and 10.4% respectively. In 1972, total private sector investment was 46.9% to of total investment. In the same year, general government was at its highest level ever of 42.9% (between 1960 and 2015), whilst public corporation investment was 10.3% of total investment. The lowest private investment to total investment ratio was in 1976, 40.9% with general government to total investment ratio at 42.5% and public corporation investment at 16.9%. In 1980 public corporation was at its highest, 22.3%, with general government at 25.2% and private investment at 52.5%.

From 1993, it is clear that private business enterprises make the largest contribution (over 60%) to investment in South Africa. However, from 2008, public corporations surpassed general government to become the second largest contributor to gross investment after private investment. Furthermore, between 1960 and 1993, general government contributed over 20% of gross capital formation. This investment by general government shrunk below 20% from 1993 onwards. The share of public investment contributed by both general government and public entities was just below 30% from 2001 to 2007. This increased slightly above 30%, but below 40% from 2008 to 2015 (SARB, 2016).

In contrast, the share of investment contributed by private enterprise was above 70% from 2001 to 2007, after which it declined below 60%. It then rose steadily and was back above 60% in 2011 (SARB, 2016).

Policies Impacting Investment

A number of policies have been implemented by the government in order to promote investment in South Africa. These include, amongst others, the Reconstruction and Development Programme of 1994, the Growth, Employment and Redistribution Macroeconomic Strategy of 1996, the Accelerated and Shared Growth Initiative for South Africa of 2004 and the National Development Plan of 2011.

The Reconstruction and Development Programme of 1994 (RDP) policy, identified the decline in the investment levels over the past decade as a problem that needed to be addressed. This decline in investment led to a decline in growth and average real

incomes (ANC, 1994, p. 77). By 1994, the decline in investment within the public and private sectors, and capital flight, contributed to an ageing capital stock and contraction in the manufacturing sector (ANC, 1994, p. 77). Capacity utilisation of manufacturing plant and equipment was also at very low levels (ANC, 1994, p. 78). Moreover, speculative investment replaced productive investment, with a consequent decline in job creation and overall employment levels (ANC, 1994, p. 77). As a result, one stated necessity was to create a conducive environment for boosting investment by regulating liquid fuels (ANC, 1994, p. 36). One objective was for public sector investment to complement the role of the private sector and community participation in stimulating reconstruction and development (ANC, 1994, p. 85). Throughout the RDP, boosting investment is noted as an imperative to be spurred on by both private and public investment, with the ultimate goal of increasing growth, job opportunities and reducing unemployment.

The Growth, Employment and Redistribution a Macroeconomic Strategy of 1996 (GEAR), in order to ensure accelerated growth, identified the need to cut back government consumption expenditure, keep in check private and public sector wage increases, accelerate tariff reform to compensate for the depreciation and finally, improve domestic savings performance. The overall expected outcomes of this were to create a climate conducive for continued investor confidence, facilitate the financing of both private sector investment and accelerate development expenditure (Department of Finance, 1996, p. 5).

The overall goal of the Accelerated and Shared Growth Initiative for South Africa of 2004 (ASGISA) was to halve poverty and unemployment by 2014. This would be done by encouraging investment in the county, having noted limited new investment. It highlights volatility in the currency as a deterrent to investment outside the commodity sector. It recognised inadequacies in infrastructure and investment that had a negative impact on the transport sector leading to escalated transport costs. The approach to dealing with this was not through new economic policies, but rather, by a set of initiatives. For instance, one response would be by government ramping up public sector investment from 6% of GDP, then in 2004, to 8%. This would be achieved through a cash injection over the next three years. However, Areas of public investment would be electronic communications (e.g. broadband); stadia in preparation for the 2010 World Cup; and provincial infrastructure projects with major ASGISA impact ranging from the transport sector, agricultural and manufacturing sector.

Private-sector investment would be promoted through sector strategies. This would entail the broadening of the broader National Industrial Policy Framework; determination of priority sectors; and targeted educational responses to skills challenges. However, the ASGISA put more emphasis on public investment than private investment, (Republic of South Africa, 2004, pp. 6-8).

The National Development Plan of 2011 (NDP) specifies infrastructure development as a key strategy for boosting growth and addressing unemployment. The NDP specifically states: that:

"Higher investment, supported by better public infrastructure and skills, will enable the economy to grow faster and become more productive. Rising employment and productivity will lead to rising incomes and living standards and less inequality. Shifting the economy towards more investment and lower consumption is necessary for long-term economic prosperity." (National Planning Commission, 2011, p. 39).

Even the plans of provincial and municipal governments show a reverence for infrastructure-led growth as a solution for growing the economy and creating unemployment. This is evidenced in the Western Cape's Provincial Strategic Plan for 2014-2019[25] and the City of Cape Town's five-year Integrated Development Plan Review for 2016/2017[26].

4. Conclusion

The aim of this paper was to explore the dynamics of savings and investment in South Africa. This was achieved through an analysis of savings and investment trends from 1960-2015. The gross domestic savings trend shows that there has been an overall decrease in the gross domestic savings to GDP ratio. From 1992 to date, the gross domestic savings to GDP ratio has been below 20%. This is due to a decline in household savings, corporate savings, and public savings. Despite a downward trend in corporate savings during this period, corporate saving rates have never reached sub-zero as in the case of household and government savings. For instance, in 2015, public savings was -R50.6 billion, household savings was –R33.2 billion, whilst corporate savings was R188.5 billion. This shows that the household and public sector are spending more than they have through borrowing. It also shows that the corporate sector is the backbone of savings in the country. Corporate savings has seemingly withstood the cyclical fluctuations in the economy better than household and public savings. There is, therefore, a need to further strengthen corporate savings, while simultaneously bolstering household and public savings. There is also a need for the country to promote both domestic and foreign investment in order to reduce unemployment. Ideally, a reduction in unemployment will reduce poverty levels and, hence, the government's social burden, which will ultimately allow for increased public savings. Expansionary policies such as a reduction in personal taxes will also increase the disposable income of households, allowing them to save more. There is also a need for educational and awareness interventions that will enable households to deal better with their finances. This is because household debt

[25] Western Cape Government, 2014.
[26] City of Cape Town, 2016.

dampens household saving. Challenges highlighted need to be addressed such as high inflationary pressures which need to remain under control with inflation kept within the target bands in order to enable both private and public savings.

On the investment front, the study found that the overall investment in South Africa has been erratic. Between 1960 and 1986, South Africa experienced the highest levels of investment with the ratio of gross capital to GDP vacillating above 20% of GDP. A short period of growth in investment was observed between 2001 and 2008, with the gross domestic savings to GDP ratio rising from 14.8% to 21.6%, respectively. The average investment rate recorded during the period 1990-2014 was found to be relatively low when compared with the average rate recorded during the period, 1974-1984. In order to boost investment, there is need for the country to pursue policies that are likely to boost the cost of capital and returns on investment. This will make South Africa more attractive to foreign direct investment, relative to other countries. Investment in the country has been largely dependent on private business enterprises rather than the public sector (public corporations and general government), except for a few years in the 1970s when public sector investment exceeded private investment. There is need for the country to pursue policies to address the challenges highlighted, for example, there is need to boost the cost of capital and returns on investment, in order to make South Africa more attractive to foreign direct investment, relative to other countries. There is also a need for the country to strengthen interventions that promote domestic investment, in order to buffer itself better against global economic instability. This will ultimately lead to an increase in employment levels, aggregate demand, and economic growth, which, in turn, further stimulates investment.

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Institutions, Infrastructure and Economic Growth in Nigeria.

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Abstract: The study examines the impact of institutions and infrastructures on economic growth in Nigeria. The study contributes to the infrastructure-growth nexus literature in Nigeria by accounting for institutions into the model. The justification for the inclusion of the variable is based on the fact that good institutions will induce growth and that it will serve as an impetus for investor to invest in Nigeria. The result shows that there is long-run cointegrating relationship using the bounds-testing approach of Pesaran et al (2001). The study shows that population and institutions contributes positively to growth and that public infrastructure has a negative significant impact on growth. It is strongly recommended that that government should monitor her public infrastructure spending by reducing wastages so that it can contribute positively to growth. In addition, government should adhere to good institutions so as to increase the inflow of foreign direct investment into Nigeria.

Keywords: Institutions; Economic growth; Infrastructure, Nigeria.

JEL Classification: O43; H54; C22

1. Introduction

The centrality of public expenditure, particularly on infrastructure as an important instrument in the development process has long been acknowledged by policy makers. Public expenditure has remained a crucial issue in economic development, most especially in the developing countries, characterized by poor infrastructural service delivery, declining productivity, high level corruption and policy instability.

The poor infrastructure in almost all the developing countries has led to continued interest at investigating whether public expenditure on infrastructure has yielded significant results over time. In Nigeria for instance, the deplorable state of most infrastructural facilities and the state of disrepair and lack of maintenance culture especially in electricity, roads, railways, and water facilities as experienced by

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Nigerians affect the living standard of the populace, which lowers their productivity and ultimately economic growth in the country. Since infrastructure provide social comfort to the citizens, infrastructural deficit thereby worsen workers condition thereby lowering their productivity.

Electricity infrastructure has been in a state of comatose over the years and this has affected the citizens physically and psychologically thereby affecting economic growth. Massive interruption in the power sector usually disrupts ongoing business activities thereby impeding growth. Another problematic channel through which poor infrastructure impede economic growth is through transportation. Poor road network, underdeveloped rail lines, oligopolistic airline market have hindered the transportation of goods around the country.

Also is the decay of health infrastructure in the country. Health infrastructure deficits ultimately lead to huge capital flight in the sector since the rich seek better healthcare in advanced economy thereby expending what should have been retain in the economy. Apart from this channel, another channel through which health infrastructure deficit hamper economic growth is through the status of the labour force. An healthy population is an active population and since most workers are not insured, their health is compromised and this ultimately hinder productivity in the economy.

Against this background, it is evident that infrastructural development is paramount in transforming the economy, thus good institutions could also help in contributing to growth. The kernel of this paper is to examine the impact of institutions on infrastructures and economic growth in Nigeria. The remainder of the paper is organized as follows. Section 2 provides the theoretical linkages and the empirical evidence on infrastructure and economic growth. Section 3 provides the methodology of the study. Section 4 is devoted to empirical results. Section 5 concludes.

2. Theory and Evidence

The transmission mechanisms of infrastructure to growth are abundant in the economic growth literatures. The first transmission mechanism is given by Aschauer (1989) and Barro (1990). They opined that investments in public infrastructure enhance private sector productivity. They argued that increase in public capital stocks has a positive but decreasing impact on the marginal product of all factor inputs. Thus, the cost of production inputs falls and the level of private production increases.

The second and the third transmission mechanisms is given by Agenor and Moreno-Dodson (2006) and they are the complementarity and crowding out effects. The

complementary channel promotes growth through private capital formation. That is, public infrastructure raises the marginal productivity of private inputs, thereby raising the perceived rate of return on private capital and possibly also increasing private sector demand for physical capital. The crowding out channel, argued that an increase in public capital stocks may displace or crowd out private investment. This negative crowding out effect of infrastructure may turn into a long-term negative effect if the decrease in private capital formation persists over time. The fourth channel is suggested by Estache and Fay (2009), who argued that investment in public infrastructure can also impact investment adjustment costs, the durability of private capital, and both the demand for and supply of health and education services.

In addition, Agenor and Moreno-Dodson (2006) add labour productivity as another channel whereby public infrastructure indirectly increases growth. They opined that good access to infrastructural facilities means that workers can get to their jobs more easily and perform their job-related tasks more rapidly. Studies by Fourie (2006); Fedderke et al. (2006) and Richaud et al. 1999 also found evidence of various positive externalities induced by public infrastructure, including increased competitiveness, greater regional and international trade, expanded FDI, and finally higher profitability of domestic and foreign investment flows which raises investment ratios and boosts growth in per capita income.

There are abundance of empirical literature on public infrastructure and growth in the world over. However, the results are mixed and inconclusive owing to different data sets and econometrics techniques employed. Few among the studies that found positive effects on infrastructure on growth are; Sanchez-Robles (1998), Aigbokhan (1999), Rioja (2001), Romp and de Haan (2005), Fedderke and Bogetic (2006), Bose et al. (2007), Estache and Fay (2009), Sahoo and Dash (2009), Ijaiya and Akanbi (2009), Foster (2009), Calderón (2009), Akinlabi et al. (2011), Dissou and Didic (2011), Onakoya et al (2012) and Fasoranti (2012).

Sanchez-Robles (1998) analyzed the infrastructure growth relationship for a panel of countries for the period 1950-1992. Using the quantity of public infrastructure stock rather than public infrastructure expenditures and found a positive and significant relationship. In addition, Aigbokhan (1999) study on infrastructure, private investment and economic growth in Nigeria find evidence to support that infrastructure have positive correlation with growth. Rioja (2001), using computable general equilibrium model for Brazil, Mexico and Peru, show that the countries underinvested in infrastructure during 1970s and 1980s. The simulations suggest that infrastructure can positively impact output, private investment and welfare.

Furthermore, Romp and de Haan (2005), finds that 32 of 39 studies on OECD countries find a positive effect of infrastructure on some combination of output, efficiency, productivity, private investment, and employment. Fedderke and Bogetic (2006) also examine the impact of infrastructure investments in South Africa. They

observed that past studies have shown the effect of public infrastructure investment on economic growth to be ambiguous. They contend that this result is due to not controlling the endogeneity of infrastructure investment. When they control the endogeneity of infrastructure investment, their findings is that infrastructure investment has a positive effect on economic growth and development. Bose et al. (2007) find that government capital expenditures as a share of GDP are positively and significantly related to per capita income growth across a panel of 30 developing countries over the 1970–1980 periods. However, current expenditures are shown to have an insignificant effect on growth in these countries over this timeframe.

Estache and Fay (2009) study on developing countries shows that 9 of 12 countries indicate a positive significant impact between infrastructure and growth. Sahoo and Dash (2009) also show for India that the stock of infrastructure positively contributes to growth with unidirectional causality from infrastructure development to output growth. Ijaiya and Akanbi (2009) found long term positive linkages between infrastructure and economic growth for Nigeria. Similarly, Foster (2009) established a positive and significant relationship between infrastructure and growth in South Africa, Nigeria, Uganda and others. Calderón (2009) examines the impact of infrastructure development on economic growth in 136 African countries for the period 1960–2005, it evaluates the impact of a faster accumulation of infrastructure stocks and an enhancement in the quality of infrastructure services on economic growth across African countries over the sample period. The study findings indicate that growth is positively affected by the volume of infrastructure stocks and the quality of infrastructure services.

Akinlabi et al. (2011) examine the impact of investment in public infrastructures on poverty alleviation and consequently economic development in Nigeria. Using Cointegration and Granger causality test for the period 1981 to 2006, they found public infrastructure Granger cause GDP, but fiscal deficit does not Granger cause GDP. Dissou and Didic (2011) found for Benin that the crowding out effects of public infrastructure is sensitive to the mode of financing chosen by the government. Overall, their findings suggest that public investment in infrastructure can support private investment and sustain capital accumulation. The positive impact of public investment on private investment can be explained through the infrastructure financing channels such as public private partnerships and sub-contracting which in turn tend to crowd-in private investment.

Onakoya et al (2012) investigate the impact of infrastructure on economic growth in Nigeria. Using three-stage least squares, result shows that infrastructural investment has a significant impact on output of the economy directly through its industrial output and indirectly through the output of other sectors such as manufacturing, oil and other services. The agricultural sector is however not affected by infrastructure. Fasoranti (2012) examined the effects of disaggregated government expenditures on

infrastructure on the growth of the Nigerian economy. Results showed a long run relationship between the growth of the economy and government expenditures in education, environment and housing, health services, water resources, inflation rate, agriculture, security, transport and communication.

In contrast, studies showing a negative relationship between infrastructure and economic growth include; Landau (1986) and Barro (1991) who found that government spending on infrastructure impacted negatively on gross domestic product. Similar result was obtained from a study on Tunisian economy by Ghali (1998) showing a long run negative relationship between government spending on infrastructure and economic growth.

In addition, studies by Ghani and Din (2006), Rehman et al. (2010) and the Planning Commission (2011) for Pakistan shows there is a negative or insignificant impact of aggregate public investments on growth. Estache et al. (2009) show for Mali that foreign aid-funded infrastructure does produce Dutch Disease effects, but that the negative impacts differ by the type of investment, while economic growth attenuates these negative effects.Nketiah-Amponsah (2009) show for Ghana that aggregate government expenditures over 1970–2004 negatively impacted economic growth.

A close examination of the literatures on the relationship between infrastructure and economic growth showed that most of the analyses were on direct transmission between spending on infrastructure and growth without recourse to other channels. In this study we examine the effect of institutions on infrastructure and economic growth, which is missing in other studies.

3. Methodology

In specifying the institutions, infrastructure and economic growth relationship in Nigeria, the study adopts the specification from a study of Esfahani and Ramirez (2003) for developed countries. The long-run specification of the relationship in Nigeria is given as:

$$LnRGDP_t = \beta_1 + \beta_2 OPEN_t + \beta_3 LnINFRAS_t + \beta_4 LnPOP_t + \beta_5 INST_t + \varepsilon_t \quad (1)$$

Equation (1) is the long-run relationship for the institutions, infrastructure and economic growth in Nigeria. $LnRGDP_t$is the log of the real gross domestic product, $OPEN_t$ is the degree of openness and it is the ratio of total trade with the real gross domestic product, $LnINFRAS_t$ is the log of capital expenditure on health and education, $LnPOP_t$ is the log of total population sourced from the Central Bank of Nigeria Statistical Bulletin.$INST_t$is the average of all the institutions variables sourced from the International Country Risk Guide (ICRG) database. Based on theoretical a-priori, we expect the estimated coefficient of β_2 to β_5 to be positive.

To distinguish the short-run effects of institutions, infrastructure and economic growth nexus from their long-run effects, Equation (2) is specified in an error–correction modeling form. Following Pesaran et al.'s (2001) bounds testing approach and rewrite (1) as follows:

$$\Delta LnRGDP_t = \alpha + \sum_{i=1}^{n1} \beta_i \, \Delta LnRGDP_{t-1} + \sum_{i=0}^{n2} \delta_i \Delta \, OPEN_{t-1} + \sum_{i=0}^{n3} \varphi_i \Delta \, LnINFRAS_{t-1} + \sum_{i=0}^{n4} \gamma_i \Delta \, LnPOP_{t-1} + \sum_{i=0}^{n5} \omega_i \Delta \, INST_{t-1} + \rho_0 LnRGDP_{t-1} + \rho_1 OPEN_{t-1} + \rho_2 LnINFRAS_{t-1} + \rho_3 LnPOP_{t-1} + \rho_4 INST_{t-1} + \varepsilon_t \quad (2)$$

Without lagged level variables equation (2) will be a standard VAR model. The linear combination of lagged level variables have replaced the lagged error term from equation (1), resulting in error–correction model expressed in equation (2). To test for cointegration, the Pesaran et al. (2001) F-test for joint significance of the lagged level variables was used. Once cointegration is established, estimates of $\rho_1 - \rho_4$ normalized on $\rho_0$will yield the long-run effects of all exogenous variables. The short-run effects are reflected by the estimates of coefficients attached to first-differenced variables.

4. Results

Three unit root test namely Augmented Dickey Fuller (ADF), Phillips and Perron (PP) and the Ng and Perron (NP) was performed to determine the order of integration of the variables. The results of the unit root tests show that all the variables were stationary in their first differences except population which was significant at level with the ADF.

Table 1. Unit Root Test, 1984-2015

Variable	ADF	PP	NG-Perron
INST	-2.499	-2.402	-1.929
ΔINST	-7.028***	-7.065***	-2.646***
OPEN	-2.047	-2.106	-1.67
ΔOPEN	-5.093***	-5.074***	-2.618***
INFRAS	-0.97	-0.749	-0.886
ΔINFRAS	-5.990***	-5.966***	-2.706***
POP	-3.946***	0.113	-0.200
ΔPOP	-3.934***	-3.934***	-1.887*
RGDP	-1.782	-1.241	-1.489
ΔRGDP	-3.305**	-3.312**	-2.349**

Notes: In this paper for the NP test we use the test statistic MZt. Proper lag length for each test was chosen by AIC. ***, ** and * indicates significance at 1, 5 and 10 per cent

The study adopts the Pesaran et al (2001) approach to cointegration technique because we have different order of integration to estimate the error-correction model specified in equation (2). Using annual data for the period 1984-2015, the study imposed a maximum of four lags on each differenced variable and thereafter used the Schwarz Bayesian information criteria to select the appropriate lag length. The results of the study are reported in Panels A-Din Table 2. The first panel shows the bound test cointegration analysis. The second panels reports the short-run estimates, the third Panel reports the long-run estimates and the last panel reports diagnostic statistics. The result of the *F* bounds test in Panel A implies that at 1 per cent level, the null hypothesis of no cointegration among the variables in equation (2) was rejected. Thus, these variables co-moved in the long run.

From the short-run coefficient estimates in Panel A, it was discovered that the previous value of the gross domestic product and population have short-run significant coefficient obtained for every first-differenced variable, while trade openness, infrastructure and institution were statistically insignificant. In addition, the error correction is negative and statistically significant at 1 per cent level. Thus, the variables adjust back to long-run equilibrium and the speed of adjustment is about 54 per cent within a year in Nigeria.

Panel C, presents the long-run estimates of the model. It was discovered that all the variables of interest were significant except the trade openness variable. The infrastructure coefficient is negative and significant. This implies that public infrastructure contributes negatively to growth in Nigeria, thus we can conclude majority of funds meant for infrastructure were either siphoned or mismanaged by the bureaucrats and politicians. Thus, a 1 per cent increase in infrastructure leads to 0.059 per cent decrease in growth. The population elasticity is positive and significant at 1 per cent level of significance. The result shows that a 1 per cent increase in the population growth will lead to 2.80 per cent in the level of growth. The institution variable also exerts a positive and but a weak significant effect on the level of growth in Nigeria. Thus, good institutions will promote growth in Nigeria. Thus, if the institution variables increase by 1 one per cent, the level of growth will increase by about 10 per cent. One significant feature from the short-run and the long-run estimates of the institution variable is that in Nigeria, is that institution does not have significant impact on growth in the short-run, but significant in the long run. The implication is that it will take time for institution to have a significant impact on the level of growth in Nigeria.

Panel D reports the diagnostic statistics for the institution, infrastructure and growth relationship in Nigeria. It should be noted that before drawing conclusions or making

policy inference from the above regression models, it is important to perform relevant diagnostic tests in order to ascertain the reliability of the parameter estimates. Reported in Panel D, are the Lagrange multiplier (LM), Ramsey's RESET, Jarque-Bera and the Breusch-Pagan-Godfrey statistics. The LM statistic is used to test for first-order serial correlation, the RESET statistic is for model specification, while the Jarque-Bera statistic is to test the normality of the model and the Breusch-Pagan-Godfrey statistic is to test for heteroscedasticity. All

Table 2. Full Information Estimates for Institution, Infrastructure and Growth Relationship in Nigeria

Panel A: Bound Testing					
F_{lrgdp} (LRGDP, OPEN, LINFRAS, LPOP, INST)					5.789***
Critical Values	1%		5%		10%
I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
3.74	5.06	2.86	4.01	2.45	3.52
Panel B: Short-Run Estimates					
Variables	**Coefficient**		**S.E**		**T-test**
D(LRGDP(-1))	0.491		0.188		2.606**
D(OPEN)	-0.156		0.171		-0.909
D(LINFRAS)	0.003		0.018		0.149
D(LINFRAS(-1))	0.029		0.021		1.456
D(LPOP)	88.670		26.023		3.407***
D(INST)	0.005		0.025		0.186
ECM	-0.535		0.134		-3.994***
Panel C: Long-Run Estimates					
Variables	**Coefficient**		**S.E**		**T-test**
Constant	-46.158		5.519		-8.363***
OPEN	-0.717		0.546		-1.312
LINFRAS	-0.059		0.028		-2.059*
LPOP	2.804		0.269		10.396***
INST	0.097		0.048		2.002*
Panel D: Diagnostic Test					
RESET	**LM**	**Jarque-Bera**	**B-P-G Test**	**CUSUM**	**CUSUMSQ**
1.285	2.465	3.101	1.064	Stable	Stable

Note:(a)***,** and * indicate level of significance at 1, 5 and 10 percent respectively.

(b) Critical values are obtained from Pesaran et al (2001). The results for the ARDL approach were generated using the MICROFIT software.

(c)RESET is the Ramsey's test for functional form.

(d) LM is the Lagrange multiplier test of first-order serial correlation.

(e) Jarque-Bera is the normality test

(f) B-P-G Test is the Breusch-Pagan-Godfrey heteroscedasticity test

the four statistics are insignificant supporting autocorrelation free residuals, correctly specified model, normality of the model and constant finite variance. Also, the CUSUM and the CUMUMSQ shows that the short-run and the long-run estimates are stable because the plots of the statistics are stay within a significance level of 5 percent.

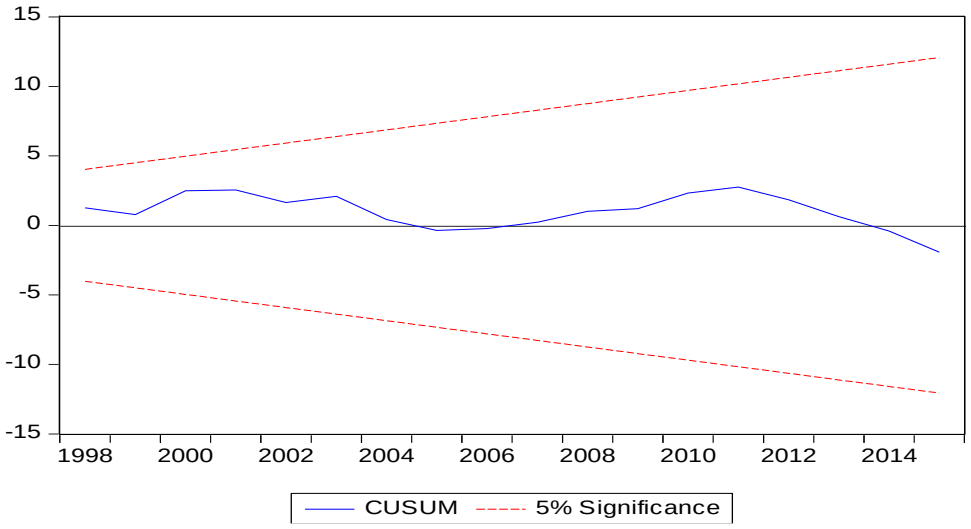
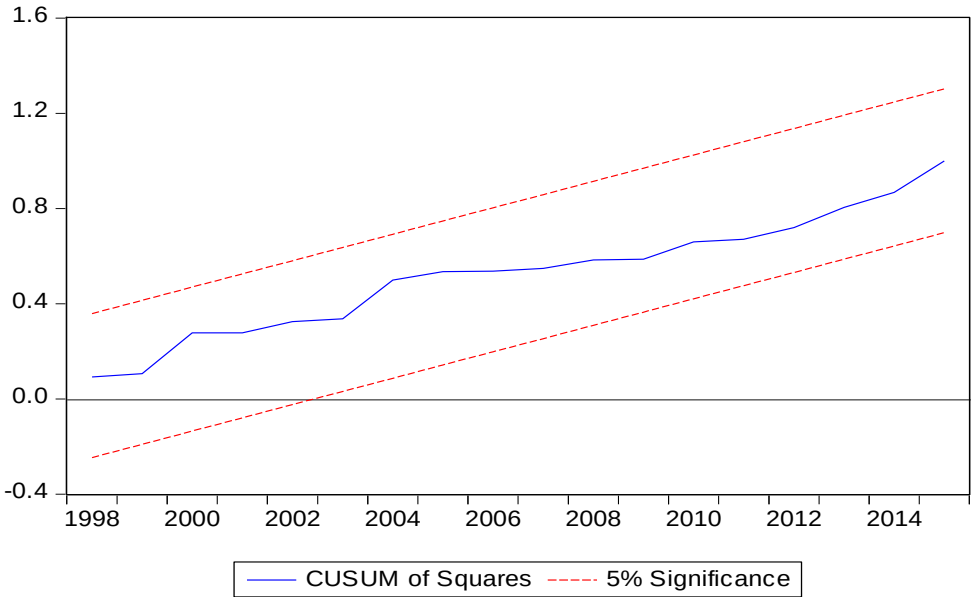


Figure 1. Plots of CUSUM AND CUSUMSQ



5. Summary and Conclusion

This study examines the impact of institutions and infrastructures on economic growth in Nigeria. We contribute to the infrastructure-growth nexus literature in Nigeria by including institutions into the model. The justification for the inclusion of the variable is based on the fact that good institutions will induce growth and that it will serve as an impetus for investor to invest in Nigeria. The result shows that there is long-run cointegrating relationship using the bounds-testing approach of Pesaran et al (2001). The study also shows that in the short-run, it is only the past value of the gross domestic product and population that contributes to the level of growth in Nigeria. However, in the long run, we found that population and institutions contributes positively to growth and that public infrastructure has a negative significant impact on growth. The error correction shows that the variables adjust back to equilibrium by approximately 54 per cent within a year.

The diagnostic tests shows that the model is free from autocorrelation residuals, correctly specified, has a normal distribution and constant finite variance. Also, the CUSUM and the CUMUMSQ shows that the short-run and the long-run estimates are stable. The policy implication of this result is that government should monitor her public infrastructure spending by reducing wastages so that it can contribute positively to growth. In addition, government of Nigeria should raise the standard on human capacity development as this contributes positively to growth. Also, government should adhere to good institutions so as to increase the inflow of foreign direct investment into Nigeria.

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The Impact of Governance on Economic Development in West Africa: A System GMM Dynamic Panel Approach

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Abstract: This paper examines the impact of governance on sustainable development in West Africa from 2002 – 2016. It adopts the system GMM approach, using all the six governance indicators, which include voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption. The results show that voice and accountability, political stability, government effectiveness and rule of law are positively related to development, with government effectiveness shown to have that largest impact, while regulatory quality and control of corruption are shown to be indirectly related to development in the short-run. However, in the long-run, all governance indicators are directly related to development in West African countries, with political stability and regulatory quality having the largest impact.

Keywords: Governance; West Africa; Economic Development; System GMM

JEL Classification: F63

1. Introduction

The desire to unravel the puzzles of factors influencing growth and development of nations has led to the development of many growth literatures (Nordhaus, 1992; Rajan & Zingales, 1998; Li, 2000; Solow, 1956). Most of these literatures (Nordhaus, 1992; Rajan & Zingales, 1998; Li, 2000; Solow, 1956) attributed capital and productivity to growth and development. However, Solow (1956), whose model serves as the basic reference point for almost all growth analysis, submitted that capital alone cannot account for the growth of nations; neither can it alone explain the vast geographical difference in output per head across nations. This submission has led to the development of other hypothesis and models to better explain the mystery behind growth and development of nations (Romer, 2012). Hall and Jones (1999) hypothesized that differences in capital accumulation, level of productivity, and consequently output across nations can be accounted for by differences in their social infrastructures. Social infrastructure is explained to be the institutions and

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governance that influence the economic environment within which other economic agents (households and firms) accumulate skills, capital, and produce output.

Governance has been described as the traditional and institution by which rules, regulations and other authorities of the state are executed (Kaufmann et al., 2010). The hypothesis that governance influences growth and development is supported by the works of (Knack & Keefer, 1997; Campos & Nugent, 1999; Acemoglu et al., 2000) and (UNDP, 2014) who posits that governance cannot be isolated from development and included it as one of the sustainable development goals. Contrary to this assertion, there are various scholars who have claimed that the influence of governance on development is rather over rated. Some argued that literatures linking governance to development are not without their problems. Bardhan (2005) identified omitted variable bias, Chong and Caldron (2000) challenged it on the ground of causality problems, Glaseer, et al (2004) on measurement errors and Weiss (2000) on conceptual vagueness.

Kaufmann, et al (2002) claimed that growth can be generated without institutional changes or government factor, and in fact, there is a tendency that high income level leads to better governance and not the other way round. He added that one of the most difficult issues in the field of governance is the imperfect understanding of how politics shapes governance and the development outcome Similarly, Grindle (2010) expresses her skepticism about the idea that good governance is essential to the development of a nation. She premised her argument on the economic growth of China, which has low rank in most governance indexes, yet, has enjoyed high rate of growth and development over several years. According to Kaufmann et al. (2005), good governance indicators can be classified into six; voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption. The relevance of these indicators is well documented in literatures (Fisman & Svensson, 2007); Easterly et al, 2006; Lewis, 2006; Dollar et al, 2006; Loayza et al, 2006).

Going by these indicators, West African countries have not fared well in the rating over the decades. It was rated, on the average -0.61, -0.81 and -0.82 for government effectiveness in 2002, 2008, and 2016 out of a scale of 2.5, a category classified as to too low by standard (WGI, 2017). On the other hand, the level of development in many African countries has been disappointing over the decades (Emara & Chiu, 2016). Relating governance to development, Chauvet and Collier (2004), find that developing countries with poor quality of governance will lead to less economic development. If this is true, the anticipated development in West African countries might be decades away judging by the governance indicators for the region.

In the light of this, it is incumbent to re-examine the merits of the proposition that governance significantly matters for development, and by implication, of policy prescription that developing countries should concentrate more on governance

enhancing reform if they want to achieve development. This study therefore seeks to empirically investigate the effect of governance on economic development in West Africa. This study will contribute to knowledge in the following ways; first, it is one of the first studies that will empirically investigate the effect of governance on development in West Africa as a whole. Second, in terms of methodology, most work (Okeke & Eme, 2015; Vehovar & Jager, 2003; Kassem, 2014; Sebudubudu, 2010). on governance adopted descriptive method of analysis, except for few (Albassam, 2013; Emara & Chiu, 2016; Karim et al, 2013; Alomaisi et al., 2016; Pere, 2015) in European countries and other part of Africa[34] who adopted estimation techniques on governance and development. Also, this will be one of the first studies in West Africa to look at the short-run and the long-run impact of governance on development in West Africa. This study will adopt a dynamic panel model of estimation, particularly, the Arellano and Bond Generalized Method of Moment. Dynamic panel model better captures the dynamic relationships between economic variables. Also, it[35] is one of the prominent estimation techniques for dynamic panel when N is large and T is small (Batalgi, 2008).

Objectives of the Study

The broad objective of the study is to empirically investigate the impact of governance on economic development in West Africa. The specific objectives are;

i. to empirically investigate the short-run impact of governance on development in West Africa

ii. to empirically investigate the long-run impact of governance on development in West Africa

2. Literature Review

2.1. Theorectical Review

Various attempts have been made by scholars to answer the questions of what causes growth and prosperities of nations, particularly, identifying factors responsible for the difference in growth rate among nations. Most of these scholars initially focused on physical and human capital, total factor productivity, technological progress, the progress of knowledge creation and diffusion and international trade (Helpman, 2004). These factors however, have not been able to provide satisfactory answers to the questions surrounding development of nations (Solow, 1956). Consequent to this, some scholars (Feng, 2003); Przeworski et al, 2001; Knack & Keefer, 1995; Mauro, 1995; Alesina, 1998) have begun to recognize that the roles of politics and institutions are vital to the process of development by influencing the incentives to accumulate, and accommodate changes

[34] Sub-sahara Africa, Egypt.
[35] Arellano and Bond Generalized Method of Moment.

Research looking into whether governance promotes or hinders economic development has produced three (3) schools of thought. The first is the conflict school which believes that democracy hinders economic growth, but mostly in developing countries, by creating consumption pressures, instigating distributional conflict and discouraging capital accumulation. The proponents of this theory adopted the case of South Korea, Taiwan, and Chile as evidence that "good for growth" dictatorship could create right condition for development by providing sources of political order and social control. This conclusion however, was debunked by Przeworski et al (2000), who empirically investigated the experiences of 135 countries and found that there is no trade-off between democracy and development.

The second is the compatibility theory that posits that governance positively influences growth, because the presence of fundamental human right and political right create the social environment conducive for economic development. This theory has been invested by Knack and Keefer (1995), Mauro (1995) and Alesina (1998) who confirm the existence of positive relationships between governance and growth. The third is the skeptical school that claims that there is no systematic relationship between governance and development.

According to Olson (1996) and Knack (2003), the linkages between governance and growth has been able to address some of the anomalies of the old and new growth theories, which were not able to explain the determinants of developments in most countries.

2.2. Empirical Literature

Since the end of 1980s, the importance of good governance has been dominating the international discussion about development and international assistance to Africa (Wohlmuth, 1998). This has led to various empirical investigations into the relevance of government, amidst other factors to growth and developments;

Habtumu (2008) conducted an empirical study on the roles of governance on economic performance in Sub-sahara Africa (SSA) between 1996 and 2005, using system and differenced GMM. He found that rule of law, government effectiveness, regulatory quality, political instability and voice as well as accountability influence growth in SSA, however, control of corruption has no influence on economic performance in the region. Similarly, Cooray (2009) investigated the influence of governance on economic growth and development in 71 countries (including developed, developing and transitioning countries) adopting the same methodology found that both size and quality of governance are important for economic growth, and in fact, investing in the capacity for enhanced government is a priority for the improved growth performance of the countries investigated. Their findings is corroborated in the works of Knack and Keefer (1997); Campos and Nugent (1999); Acemoglu et al. (2000).

Emara and Chiu (2016) investigated the impact of governance on economic growth in 21 Middle Eastern and North African (MENA) countries between 2009 and 2013, using Principal component analysis (PCA) method of investigation reported that constant per capita income would rise by about 2% if composite government indicator increase by one unit. Contrarily, Yerrabati and Hawkes (2015) who investigated the governance and economic growth in south and East Asia and pacific region, using meta-synthesized technics based on 29 studies with 554 estimators found out that most governance indicators, other than government effectiveness and regulation have no important effect on growth. They concluded that empirical research on governance and growth has failed to provide evidence of true effect of governance on growth.

Alomaisi et al (2016) in their analysis of the impact of governance on growth in Yemen, using multiple regression models found rule of law and political instability as the most important indicators of economic growth in Yemen, while other variables were declared no so significant. Kaufmann and Kraay (2012) on their paper titled Growth without Governance, using correlation analysis for 173 countries for the periods of 2000-2001 found that per capita income and the quality of governance are strongly positively correlated across countries. Furthermore, they adopted an empirical strategy that allows the separation of this correlation into two components; the first result confirms the existing evidence on the importance of good governance for economic development. However, the second result is rather unpopular and suggests that there is a virtuous circle in which higher incomes lead to further improvement in governance. This result is similar to the recent report from Habyarimana and Dushimayezu (2018) who studied good governance, economic growth, and development in Rwanda, adopting similar method of investigation found the existence of pro-cyclical relationship between governance and economic development. The paper did emphasize that the level of economic growth and development not only depend on fixed capital formation and labour force, but also on good governance.

Bayar (2016) empirically investigated public governance and economic growth in the transnational economies of the European Union between 2002 and 2103, using static panel analysis revealed that all governance indicators except regulatory quality had a statistically positive impact on growth, and control of corruption and rule of law had the largest impact, while political stability had the lowest impact. In the same vein, Tarek and Ahmed (2013), adopted the same methodology to investigate governance and economic performance in developing countries reported similar result, claiming that the institutional failure that characterize developing countries lead inevitably to destabilize their long-term economic growth and an improvement in governance would contribute greatly to their economic growth. Author with similar method and results to Bayar (2016) and Tarek and Ahmed (2013) are Fayissa and Nsiah (2010) on 28 sub-African countries between 1990 and 2004, and Adams

and Mengistu (2008) on privatization, governance and economic development in developing countries between 1991 and 2002.

Theoretical framework

This study adopts the theoretical framework presented by Hall and Jones (1999) using the simplest Cobb-Douglas approach.

Assume that the production function in country *i* is specified as follow;

$Y_i = K_i^{\propto}(A_i H_i)^{1-\alpha}$, …….. (1)

Where K_i represents the stock of physical capital, H_i, the amount of human capital – augmented labor employed in production, and A_i, the labor –augmenting measure of productivity. It is assumed that labor L_i is homogeneous within a country and that each unit of labor has gone through E_i years of training (education). Thus, Human capital-augmented labor is given by;

$H_i = e^{\Phi E_i} L_i$……..(2)

In equation two above, the function Φ (E) shows the efficiency of a unit of labor with E years of training relative to one with no training (Φ (0) = 0). The derivative Φ' (E) is return to training estimated in a mincerian wage regression (Mincer 1974): an additional year of training raises a worker's efficiency proportionally by Φ' (E). This is suggested by Bils and Klenow (1996) that it is the appropriate way to incorporate training into an aggregate production function. It is noted that if Φ (E) = 0 for all E, it is the standard production function for undifferentiated labor.

3. Methodology

The study adopts a dynamic panel model in estimating the effect of governance on economic development in West Africa[37] between 2002 and 2016. Dynamic panel estimation is more befitting in capturing the dynamic behavior of economic relationships. This model is closer to reality than any other panel model of estimation (Olubusoye et al., 2016). A typical dynamics panel model is specified as follow;

$y_{it}=\delta y_{i,t-1} + X_{it}'\beta + u_i + \eta_{it}$……..(1)

Where y_{it} is the regressand for individual country i over the period t, X'_{it} is the matrix of exogenous variables for individual country over the period t, u_i is the individual country specific effect, and η_{it}, the remainder disturbance term.

[37] Nigeria, Niger, Gambia, Liberia, Burkinafaso, Cote d'ivoire, Cape verde, Sierra-leone, Mali, Quinea, Togo, Quinea Bussau, Senegal, Mauritania, Ghana.

According to Batalgi (2008), dynamic model is characterized by two sources of persistency over time. First, autocorrelation resulting from the inclusion of lagged dependent variable as an explanatory variable. That is, $\delta y_{i,t-1}$ is correlated with error tern η_{it} ($E(\delta y_{i,t-1},\ \eta_{it} \neq 0)$). Second is the unobserved main effects and interaction effect which characterized the heterogeneity among units.

One of the important methods of estimating dynamic panel data models especially when dealing with many countries (N) and within a short time period (T) is the Arellano and Bond Generalized Method of Moment (GMM). This method was introduced by Arellano and Bond (1991) by differencing the dynamic model (eqn 1) to get rid of the two persistences[38] associated with dynamic models. This explains the reasons why this model is also referred to as differenced GMM dynamic panel data estimator. Adopting this method, equation 1 becomes:

$y_{it} - y_{i,t-1} = \delta(y_{i,t-1} - y_{i,t-2}) + \beta(X'_{it} - X'_{i,t-1}) + (\eta_{it} - \eta_{i,t-1})$…… …...(2)

Where $(\eta_{it} - \eta_{i,t-1})$ is assumed to follow first order moving average with unit root.

Although, all dynamic models are short-run model and can only estimate short-run coefficient, some manipulation are required to obtain long-run coefficient as demonstrated below;

In the long-run, $y_{i,t} = y_{i.t-1}$; therefore, substituting into equation (1), we have,

$y_{it} = \delta y_{i,t} + X'_{it}\beta + u_i + \eta_{it}$…… ….. (3)

$y_{it} - \delta y_{i,t} = X'_{it}\beta + u_i + \eta_{it}$…… (4)

$y_{it} = \left(\frac{\beta}{1-\delta}\right) X'_{it}$…… (5)

Where $\left(\frac{\beta}{1-\delta}\right)$ represent long-run elasticity between Y and X, assuming $\delta < 1$ and statistically significant (which is a necessary condition if the short-run model is to converge to a long-run solution (see Harris and Sollis, 2003).

Diagnostic Tests

Arellano and Bond (1991) proposed two test to validate the estimation. First is that there is no second-order serial correlation for the remaining disturbances of the differentiated equation. This is an essential condition as the consistency of GMM estimator rest on the assumption that $E(\Delta\eta_{it}\text{-}\Delta\eta_{i,t-2})=0$. It should be noted that first order is expected in the first differenced dynamic panel data models. Therefore, we reject null hypothesis of no autocorrelation for AR (1) and accept null hypothesis for AR (2).

[38] Autocorrelation and the unobserved effects and interaction effect which characterized the heterogeneity and units.

Second is the instrument validity test. This becomes necessary because of the potential correlation between the lagged dependent variable and the remainder of the disturbance term (Olubusoye et al., 2016). In order to determine the validity of instruments used, the Sargan and Hansen test of over-identifying restriction have been suggested. For these two tests, we must accept the null hypothesis of validity of instruments (Roodman, 2009).

Model Specification

The model is specified into two categories: with and without control variables (Labour and Capital) in other to effectively achieve the objective of this study.

Per capita growth = f(governance)……(6)

Per capita growth = f (capital, labour, governance)……. .(7)

Reparametizing the specification above, we have;

$pcg_{i,t} = \alpha pcg_{i,t-1} + \beta_j' inst_{i,t} + \eta_i + \mu_{i,t}$…….(8)

$pcg_{i,t} = \alpha pcg_{i,t-1} + \beta_j' inst_{i,t} + \gamma_i' c_{i,t} + \eta_i + \mu_{i,t}$……(9)

Where pcg denotes per capita growth, α is the autoregressive parameter, $inst_{i,t}$ *is a matric of governance which include;* voice and accountability (va), political stability (ps), regulatory quality (rq), rule of law (rof), control of corruption (coc) ang government effectiveness (ge) as identified by (Kaufmann et al., 2005). β_j' is the coefficients of institution, $c_{i,t}$, the control variables (growth rate of capital formation (gcf) and Labour force (in logarithm)), and γ_i', the coefficients to the control variables. $\eta_i and\ \mu_{i,t}$ are as previously defined in the methodology.

Scopes of Study and Sources of Data

The study covers the periods of 2002 to 2016. It is limited to these periods because of availability of data. The data were source from two different sources; voice and accountability, political stability, regulatory quality, rule of law, control of corruption, government effectiveness were gotten from World Governance Index (2017), while per capital growth, growth of capital formation and labour force were extracted from World Development Index (2017).

4. Empirical Results and Findings

MODEL 1:$pcg_{i,t} = \alpha pcg_{i,t-1} + \beta_j' inst_{i,t} + \eta_i + \mu_{i,t}$

	(1)	(2)	(3)	(4)
VARIABLES	SGMM1a	SGMM1b	SGMM1c	SGMM1d
L.pcg	0.126***	-0.0844	0.158	0.152
	(0.0483)	(0.285)	(0.153)	(0.263)
Va	2.032**	3.521**	1.932**	2.700***
	(0.921)	(1.386)	(0.893)	(1.043)
Ps	0.585	1.081	0.547	1.145
	(0.783)	(0.972)	(0.951)	(1.080)
Ge	2.414	3.011	2.666	3.259
	(2.247)	(2.695)	(2.404)	(2.463)
Rq	-2.678	-1.389	-3.264	-3.262
	(3.329)	(4.814)	(4.024)	(5.023)
Rof	1.102	-1.363	1.699	0.0960
	(2.571)	(3.141)	(2.920)	(3.452)
Coc	-2.653	-3.156*	-2.985*	-3.259*
	(1.714)	(1.862)	(1.785)	(1.833)
Constant	2.091***	2.649**	1.998**	1.874
	(0.566)	(1.154)	(0.836)	(1.235)
Observations	210	210	210	210
Number of crossid	15	15	15	15
firm effect	YES	YES	YES	YES
year effect	NO	NO	NO	NO
Hansen_test	5.932	2.980	3.732	4.710
Hansen Prob	1	0.561	1	0.452
Sargan_test	91.08	1.259	70.19	5.210
Sargan Prob	0.0998	0.868	0.197	0.391
AR(1)_test	-2.311	-1.036	-2.150	-1.476
AR(1)_P-value	0.0209	0.300	0.0315	0.140
AR(2)_test	-0.246	-0.482	-0.152	-0.107
AR(2)_P-value	0.806	0.630	0.879	0.915
No. of Instruments	83	12	69	13

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

SGMM1 denotes One-Step GMM. collapse the instrument matrix. a b c & d denote lag(1 6

Lag (2 5) lag (2 6) & lag(3 7) respectively.

From the model above, different lags ((1 6), (2 5), (2 6), and (3 7)) were introduced for the estimation. These lags were introduced to avoid instruments proliferation (Roodman, 2009). It was discovered that the model with lag (1 6) met all the

requirements for a valid model using system GMM, while the rest fall short. Therefore, the model with lag (1 6) (SGMM1a) will be considered for this analysis.

The autoregressive parameter was shown to be less than one and statistically significant. According to Roodman (2009), the estimated coefficients on the lagged dependent variable (α) should be less than absolute unity, and statistically significant. If not, the system GMM is not valid. The estimated coefficient of the autoregressive parameter (α) lies within the range of dynamic stability with a value of 0.126, and statistically significant at 1%.

The result shows that all governance indexes, other than regulatory quality and control of corruption are positively related to development in West Africa. The negative effect of control of corruption on development corroborates the findings of Yerrabati and Hawkes (2015) and the negative effect of regulatory quality on development corresponds to the findings of Bayar, 2016). From the findings, it is shown that a 1% increase in voice and accountability would improve economic development by 2.03%, and statistically significant at 5%. A 1% improvement in political stability would lead to 0.59% increase in economic development, in addition, a 1% increase in government effectiveness would accelerate economic growth by 2.41% and a 1% improvement in rule of law, improves developments by 1.10%. However, political stability, government effectiveness and rule of law are not statistically significant. These results are similar to the findings of Knack and Keefer (1997); Campos and Nugent (1999).

The robustness check shows that instrument are valid (from Hansen and Sargan test above), and there is no second order autocorrelation (AR(2)).

MODEL 2: $pcg_{i,t} = \alpha pcg_{i,t-1} + \beta_j' inst_{i,t} + \gamma_i' c_{i,t} + \eta_i + \mu_{i,t}$

	(1)	(2)	(3)	(4)
VARIABLES	SGMM1a	SGMM1b	SGMM1c	SGMM1d
L.pcg	0.106**	-0.0751	0.0812	0.207
	(0.0464)	(0.282)	(0.108)	(0.308)
Gcf	0.0559***	0.0527*	0.0459**	0.0570**
	(0.0183)	(0.0317)	(0.0209)	(0.0287)
Lnlf	1.656**	1.590**	1.545**	1.631**
	(0.702)	(0.710)	(0.697)	(0.730)
Va	0.513	2.216	0.851	1.083
	(1.201)	(1.698)	(1.052)	(1.760)
Ps	2.445**	2.612**	2.170*	2.724**
	(1.169)	(1.109)	(1.201)	(1.375)
Ge	2.304	2.839	2.345	3.107
	(2.002)	(2.329)	(2.165)	(2.100)
Rq	-6.076	-4.489	-5.802	-7.015
	(4.277)	(6.186)	(4.836)	(6.704)
Rof	1.355	-0.776	1.624	1.234
	(2.627)	(3.437)	(2.755)	(4.234)
Coc	-1.016	-2.042*	-1.464	-2.039*

	(1.063)	(1.169)	(0.964)	(1.122)
Constant	-24.38**	-22.92**	-22.37**	-24.51**
	(10.89)	(11.67)	(11.05)	(12.05)
Observations	202	202	202	202
Number of crossed	15	15	15	15
firm effect	YES	YES	YES	YES
year effect	NO	NO	NO	NO
Hansen_test	4.010	2.801	6.461	4.463
Hansen Prob	1	0.592	1	0.485
Sargan_test	84.71	1.542	69.48	4.320
Sargan Prob	0.208	0.819	0.213	0.504
AR(1)_test	-2.427	-1.095	-2.625	-1.443
AR(1)_P-value	0.0152	0.273	0.00868	0.149
AR(2)_test	-0.236	-0.436	-0.250	-0.0108
AR(2)_P-value	0.813	0.663	0.803	0.991
No. of Instruments	85	14	71	15

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

SGMM1 denotes One-Step GMM. collapse the instrument matrix. a b c & d denote lag(1 6)

Lag (2 5), lag(2 6), & lag(3 7) respectively.

Just like MODEL 1, lag (1 6), (2 5), (2 6) and (3 7), were used to estimate the model, and the model with lag (1 6) meet all criteria for a valid model using GMM. Therefore, the model with lag (1 6) (SGMMIa) will be considered.

From model SGMMIa, the autoregressive parameter meets the dynamic stability condition of less than absolute 1 and it is statistically significant. The result validates Solow's assertion of the importance of labour and capital in the economic development of a Nation. It shows that a 1% improvement in capital formation would accelerate growth by 0.06%, and statistically significant at 1%. Also, a 1 percent increase in labour force would facilitate development by 1.66%, and statistically significant at 5%. On governance, the result shows that, voice and accountability, political stability, government effectiveness and rule of law contribute positively to development, but it is political stability that exerts the most influence on development with a statistically significant positive coefficient of 2.45. However, regulatory quality and control of corruption are found to have an insignificantly negative effect on development in West Africa. The result confirms that the instruments are valid, and there is no higher other autocorrelation.

Table 1. Long-run coefficients $\left(\frac{\beta}{1-\delta}\right)$ from SGMM1a

variables	with capital and labour	without capital and labour
gcf	0.062527964	-
lnlf	1.754051478	-
va	-0.782012195	2.324942792
ps	5.020533881	0.585
ge	-1.594463668	2.414
rg	4.659509202	2.59496124
rof	0.191492369	2.655421687
coc	2.861971831	1.876237624

Source: Author's computation

The results above show that with labour and capital in the model, all variables other than voice and accountability and government effectiveness contribute positively to growth. That is, in the long-run, with a given level of labour and capital, voice and accountability, as well as government effectiveness contribute negatively to development. Conversely, the model that factors in only governance shows that in the long-run, all governance indicators contributes positively to growth in West Africa.

5. Conclusion and Recommendation

Having empirically investigated the role of governance in the economic development of West Africa Sub-Region between the periods of 2002 and 2016, it was found that governance is an important determinant of growth in the region with or without capital and labour. Particularly, governance was found to contribute more to development in the long-run than in the short-run. These findings are consistent with the findings of Tarek and Ahmed (2013) on developing countries, Alomaisi et al (2016) on Yemen, Habtumu (2008). Therefore, the poor economic performance of West African countries can be partly attributed to poor governance in the Sub-region.

It is therefore recommended that West African countries should encourage continuity of government to facilitate political stability, allow for true democracy by providing mechanisms that allow the voice of the citizens to be held and put in place strong institutions that promote accountability, limit corruption and facilitate operation of the rule of law.

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