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 $(\mathrm{n} + \mathrm{g} + \ \delta)$. 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:

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

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:

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

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

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 sk_{it} and is obtained from Pen World Table 7.0. Gross secondary school enrolment is used to proxy 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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