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Innovation, Technology and Economic Growth, Do Patent Rights and Technology Exports Influence Economic Growth in Kenya?

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A B S T R A C T

This paper seeks to determine the link between patent protection, technology and the rate of economic growth in the period 1990-2018 using Romer's model of endogenous growth and Neoclassical model of economic growth. Least squares is used to check for significance of innovation and technology in influencing economic growth. The results show that, innovation (patent rights) and technology (manufactured and high technology exports) are positively important in determining the rate of economic growth in Kenya. From the results, this paper recommends that there is need for government to encourage innovation through providing patent rights as a means of enhancing economic growth through innovation in new methods and technologies in production and service offering. As well, the government should embrace technology as means of expanding on returns to scale on resources, hence, economic growth.

A R T I C L E I N F O

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1. INTRODUCTION

The basic rationalization of intellectual property (IP) rights are the tradeoff between static and dynamic efficiency (Nordhaus 1969; Scherer 1972). Economic theorizing on the fundamental tradeoff in the design of optimal IP regime has flourished, and, the policy debate has been intense. By contrast, there is scant empirical evidence to validate the basic premise that IP rights have fostered or do foster invention and creative work, still less economic growth (Hall 2007; Hu and Jaffe 2007). According to Mark & Francis (1996), innovation stimulates growth by causing the introduction of new goods and services to

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the market. Additionally, innovation results in improved methods for production and provision of good and services. Therefore, encouraging innovation may therefore be an important determinant for explaining an economy's growth rates. While empirical support for the hypothesis that stronger IP rights lead to greater innovation is sparse, pressure to strengthen IP rights has been unrelenting.

Advances in research on technology policy and their contributions to the economic growth have, as well, attracted increasing notice in recent years. Economic research addressing science and technology policy matters, however, has remained largely preoccupied with something else. Interest in R&D and innovation policy has certainly increased recently among academic economists, even those predisposed to follow the discipline's "mainstream" (Helpman, 1998; Jaffe et al., 2004; Romer, 2000; Klette and Moen, 2000). Undoubtedly, this development reflects the widely shared perception that the higher levels and rates of growth enjoyed by some national economies are attribuTable to the greater success of those countries in exploiting emerging technological opportunities. Most of the economists drawn to this area are intrigued by the possibility that the positive results observed can be traced to effective policy programs, that is to say, to programs whose comparative effectiveness stemmed from a correct sequencing of the stimuli given to a proper mix of exploratory and commercially oriented R&D, and to private sector investments in technology-embodying capital and human resource training (Mohnen and Roller, 2001; Trajtenberg, 2002).

Motivated by Mark & Francis (1996), our key innovation was to address the possible impact of patent rights and manufactured and high technology exports with capital formation as the control variable.

2. LITERATURE REVIEW

2.1 Theoretical Review

Romer's 1990 model of endogenous growth shifts the primary factor contributing to economic growth away from simple capital accumulation to the use and development of human capital. The model argues that devotion of more human capital to research leads to a greater number of innovations. Judd (1985) develops a theoretical model which examines the impact that different patent rules have on the flow of product innovation by profit maximizing inventor-investors and seeks to determine a socially optimal level of innovation through patent protection. Judd finds that patents contribute to a self-sustaining cyclical pattern of innovation and growth. Neoclassical model of economic growth suggests that diminishing returns to capital in relatively wealthier countries have been avoided due to advances in technology. Hence, an understanding of how technological change has transpired, in turn allowing countries to experience economic growth.

2.2 Empirical Review

Park and Ginarte (1997) used the index to study the relation of economic growth, investment, and R&D expenditure to patent rights. They found no relationship between stronger patent rights and economic growth. However, among richer countries (with above median income), stronger patent rights were positively related to investment and R&D. There was no such relation among poorer countries. Lederman and Saenz (2005) investigated the impact of patent grants and R&D expenditures on cross-country differences in economic growth. To account for patents granted and R&D expenditure possibly being endogenous, they used the Ginarte-Park index as an instrument. However, they did not consider that patent laws (as characterized by the Ginarte-Park index) themselves might be endogenous to national economic growth.

Some existing studies, however, have not found a significant relationship between the two variables when focusing on developed and developing countries (Gould and Gruben, 1996; Schneider, 2005) or middle income countries (Falvey et al., 2006; Kim et al., 2012). Other studies have found that the strength of patent law protection has an indirect effect on economic growth which is moderated by total factor productivity (Thompson and Rushing, 1999). However, Kashcheeva (2013) researched the joint effect of the strength of patent law protection and level of inward FDI, and revealed a significantly negative relationship with the economic growth of developing countries. The author also found that the joint effect had an insignificant relationship with the economic growth of developed countries, and of all countries as a whole. This negative finding contradicts the results of the existing literature and requires further attention in future empirical studies

3. METHODOLOGY

For this paper to determine whether patent rights and technology exports do affect economic growth in Kenya, the regression model is borrowed and modified from Mark & Francis (1996) who carries an empirical analysis of the impact of patent protection on economic growth.

$$GR7085_i = \beta_0 + \beta_1 PAT_i + \beta_2 X_i + \mu_{1i} \qquad (1)$$

Where GR7085 is the growth rate of real GDP per capita from1970 to 1985, PATi is the patent level and Xi is a vector of variables which are likely to influence GDP growth respectively. The model is modified to include manufactured and high technology exports, and capital formation in the vector of variables likely to influence economic growth as taken from other literature review. The general function, therefore, is :

$$GDPRt = f(MHTECHXt, PTTRt, KFt, \mu t) \qquad (2)$$

Where; GDPRt= the gross domestic product growth rate at time t, MHTECHXt= the manufactured and high technology exports at time t, PTTRt = the patent applications by residents at time t, KFt = the capital formation at time t, and μt = the error term at time t. From the function above a linear regression model is specified as follows:

$$GDPRt = \beta_0 + \beta_1\, PTTRt + \beta_2\, MHTECHXt + \beta_3\, KFt + \mu t$$

Where; βs are the parameter estimates

3.1 Data Measurement

Secondary data was obtained from the World Bank Database for a period 0f 1990-2018

Patent Rights – Patent applications made by residents

Technology – Manufactured and high technology exports as a percentage of exports

Economic Growth – Real gross domestic product growth rate (2010 constant prices)

Capital Formation – Growth rate of capital formation

3.2 Data Analysis

The paper reconciles the assumptions of the model; normality, homoskedasticity, no serial correlation and no multicollinearity. After checking if the assumptions are met, the paper estimates the linear regression model to check for individual parameters significance.

4. RESULTS AND DISCUSSIONS

The paper reconciles the assumptions of the model by carrying out normality test, multicollinearity test, autocorrelation test and heteroskedasticity test.

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4.1 Normality Test

This is employed to check whether the disturbance term is normally distributed. Jacque Bera normality test is used and the results given as below:-

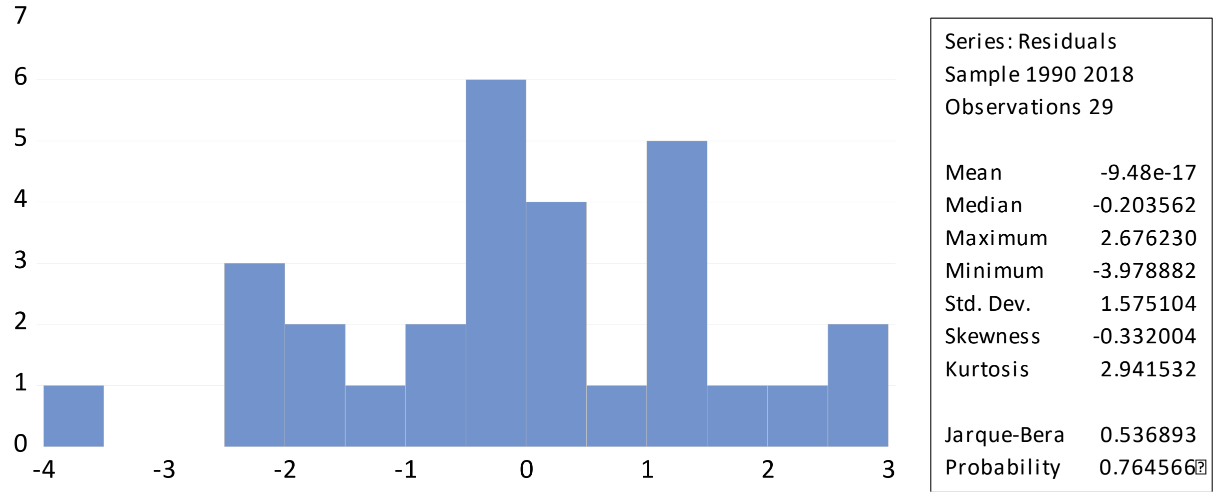

Figure 1. Normality Test

Source: Author, 2021

The null hypothesis for Jarque - Bera test states that the disturbance term is normally distributed. Given the calculated probability value, 0.764566, is greater than the critical p-value, 0.05 at the 5% level of significance, the paper fails to reject the null hypothesis and normality is assumed.

4.2 Multicollinearity Test

Multicollinearity is a problem of degree of association. When the correlations among the independent regression variables are minor, the effects may not be serious. A higher degree of Multicollinearity may have an adverse effect on the regression results leading to unreliable regression estimates (although, unreliability does not mean that the estimates are poor) and its presence can be depicted by highly estimated standard errors and high coefficient of determination (Gujarat, 2004). To detect Multicollinearity, correlation analysis among the independent variables centered Variance Inflation Factor (VIF) is employed and the results are shown below:

Table 1. Variance Inflation Factors
Date: 09/08/21 Time: 17:29
Sample: 1990 2018
Included observations: 29

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	1.524065	15.90615	NA
PTTR	3.35E-05	2.476620	1.318650
MHTECHX	0.005355	19.97065	1.341115
KF	0.000853	1.362671	1.022506

Source: Author, 2021

Multicollinearity of less than 10 is not serious hence from the Table above; there is no serious multicollinearity of the coefficients as all the centered VIF (1.318, 1.341115 and 1.022506) are less than 10.

4.3 Autocorrelation Test

Autocorrelation is the relationship between observation of the error term for one time period with the error term for a subsequent time period. Serial correlation causes OLS to no longer be a minimum variance estimator. The paper uses Breush – Godfrey LM test to check for serial correlation as shown in Table 2 below.

Table 2. Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 1 lag

F-statistic	0.042876	Prob. F(1,24)	0.8377
Obs*R-squared	0.051716	Prob. Chi-Square(1)	0.8201

Source: Author, 2021

The results in Table 2 above indicate that, the null hypothesis; no serial correlation at up to 1 lag is not rejected as the probability for F and Chi-Square (0.8377 and 0.8291 respectively) are greater than critical p-value of 0.05 at the 5% level of significance. Therefore, there is no serial correlation

4.4 Heteroskedasticity Test

The error term in the data is assumed to be random with a constant mean and variance (homoskedasticity) and is not related to any of the variables. To test for heteroskedasticity a Breush – Pagan – Godfrey test is employed as shown in Table 3 below.

Table 3. Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	0.834043	Prob. F(3,25)	0.4878
Obs*R-squared	2.638405	Prob. Chi-Square(3)	0.4508
Scaled explained SS	1.903444	Prob. Chi-Square(3)	0.5927

Source: Author, 2021

The results in Table 3 above indicate that the p-values for F and Chi-Square (0.4878 and 0.4508 respectively) are greater than the critical p- value of 0.05 at the 5% level of significance. Therefore, the null hypothesis; Homoskedasticity is not rejected, thus, homoskedasticity is assumed.

REGRESSION ANALYSIS RESULTS

given that the assumptions of the model are met, the linear regression model is estimated as shown in Table 4 below.

Table 4. OLS Estimation
Dependent Variable: GDPR
Method: Least Squares
Date: 09/08/21 Time: 17:27
Sample: 1990 2018
Included observations: 29

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.355423	1.234530	-1.097926	0.2827
PTTR	0.012248	0.005791	2.114992	0.0446
MHTECHX	0.226928	0.073179	3.101021	0.0047
KF	0.055408	0.029201	1.897455	0.0694

R-squared	0.567176	Mean dependent var	3.834724
Adjusted R-squared	0.515237	S.D. dependent var	2.394160
S.E. of regression	1.666933	Durbin-Watson stat	1.916951
Sum squared resid	69.46665		
F-statistic	10.92004		
Prob(F-statistic)	0.000090		

Source: Author, 2021

The regression results in Table 4 above indicate that, PTTR and MHTECHX are positively significant in influencing economic growth. The calculated P- values, 0.0446 and 0.0047, for PTTR and MHTECHX respectively are less than the critical P-value of 0.05 at the 5% level of significance. The null hypothesis that the parameter estimates for PTTR and MHTECHX are not significant is rejected and, therefore, treated as significant. KF is not statistically significant in determining economic growth as the calculated P-value, 0.0694, is greater than the critical P-value of 0.05 at the 5% level of significance. The coefficient of determination is 0.5152 after adjustment, indicating that 51.52% of the changes in economic growth are explained by the explanatory variables used. This means that, 48.48% of the variations are explained by other variables not included in this paper. This results are inconsistent with Park and ginarte (1997), who finds no relationship between patent rights, and economic growth in poorer countries and as well inconsistent with Kashcheeva (2013), who finds a negative relationship between patent rights and economic growth.

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The paper concludes that, patent rights applications have a positive relationship with economic growth. This shows that, innovations made lead to increase in the growth rate of real gross domestic product. the paper as well concludes that, technology is an important factor towards economic growth. This is as the results indicate that an increase in the levels of manufactured and high technology exports leads to an increase in the growth rate of real gross domestic product in Kenya.

5.2 Recommendation

The paper recommends that there is need for government to use intellectual property rights as a means of encouraging innovations that will bring forth new methods and technologies of production and service offering to enhance the levels of economic growth. The government as well, should encourage and embrace new technologies as a means of expanding on the returns to scale from capital which cannot be achieved through traditional methods.

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