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ASSESSING THE IMPACT OF QUALITY OF EDUCATION ON THE KNOWLEDGE ECONOMY: EVIDENCE FROM ALGERIA

Mourad Benrouina, **ORCID:** https://orcid.org/0009-0004-0316-8607

PhD Student in Econometrics, Laboratoire des sciences et environnement, Faculty of Business, Economics and Management Sciences, University of Tamanghasset, Algeria

Omar Malki, **ORCID:** https://orcid.org/0009-0009-9155-882X

Lecturer "A", Economy, Faculty of Business, Economics and Management Sciences, University of Tamanghasset, Algeria

Corresponding author: Mourad Benrouina, m.benrouina@gmail.com

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Abstract: *This research was focused on Algeria and looked at how education quality affected the knowledge economy. Two indicators of the knowledge economy—the number of fixed line subscribers and the number of internet subscribers—were examined for their effects on Algeria's educational system. The theoretical anchor was the endogenous or new growth hypothesis. The study used an ex-post facto research design. Secondary sources were used to get panel-structured data that spanned 48 provinces and 22 years (1999–2020). The equations were estimated using the fixed-random effect model and Hausman test. The Kao (Engle Ganger-based) cointegration test proved that the series did indeed have a long-run connection. The findings indicated that the knowledge economy was boosted by a rise in students' Baccalaureate and Intermediate test success rates. This is due to the fact that a rise in exam success rates indicates that individuals at various educational levels are now receiving education of a higher caliber, and the economy depends on this caliber of education. The rise in students and professors is a sign that there are more knowledgeable people and specialized educators accessible to fuel the knowledge economy. As more educated citizens pass their exams and graduate from college, they are hired from the labor market into industries as significant production factors whose skills, values, and knowledge acquired through specialized training are expected to promote machine handling and coordination of other human and nonhuman production factors to fuel the knowledge economy. Teachers should be provided with ongoing professional development opportunities to help them provide instruction at all educational levels, according to a recommendation. This would improve their ability to educate and inspire students and help them do better on their intermediate and baccalaureate exams. To make it easy for instructors and academics to participate, the training should be offered as sandwich courses, seminars, conferences, workshops, and even full-time training programs*.

Keywords: assessing, education, quality of education, knowledge economy.

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1. Introduction

The acknowledgement of information as a catalyst for economic expansion and development is a new movement that is garnering attention on a worldwide scale (Nurunnabi, 2017). The use of "knowledge" as a strategic resource for economic growth has contributed to the advanced countries' technical improvement, which has improved the quality of life for their populations. Intellectual capital (knowledge), breakthroughs in ICT, science and technology (S&T), and inventions all contributed to these achievements. This brought about the emergence of riches and possibilities for those living in developed nations (Bano & Taylor, 2015).

Knowledge has been consigned to the background on the path towards economic success in the majority of emerging nations, where most of their wealth and economic progress originate from its basic output (Tchamyou, 2020). Yet, such reliance on basic resources alone cannot result in the necessary degree of economic growth and development in the knowledge-based global economy of the twenty-first century (Nurunnabi, 2017). In essence, economic progress cannot be sustained by natural resources alone. It implies that knowledge as a foundation for attaining sustainable economic growth requires a paradigm shift. This is due to the fact that human and intellectual capital are the primary sources of value and competitive edge in the modern world.

Any economy in which information development, exploitation, and usage play a significant role in the creation of national wealth is referred to as a "knowledge-driven economy," also known as "the new economy" (Asongu & Nwachukwu, 2016). In a knowledge-based economy, cutting-edge concepts and technologies are crucial to the expansion and advancement of the economy (Kuerová, 2021). Consumers demand and seek out smarter products with more ease in a knowledge-based economy where intellectual property serves as the product (goods) and innovation is promoted by businesses, academic institutions, and other organizations as a technical leader (Tchamyou, 2017). The Organization for Economic Cooperation and Development (OECD) first described a knowledge-based economy as "an economy that is directly based on the creation, diffusion, and application of knowledge and information." From the descriptions given above, it is implied that knowledge is now playing the role of a significant and potent driver of manufacturing and innovation (Chatterji & Kiran, 2017). Knowledge has grown more valuable to producers as a result of quick advancements in ICT, speedy scientific and technical advancements, worldwide rivalry, and shifting patterns of demand for products and services (Oluwatobi, Olurinola, Alege, & Ogundipe, 2020).

Effective application of information and creativity to a nation's economic life is the norm in a knowledge-driven economy (Tchamyou, 2017). Several of the measures of knowledge economy growth take into account knowledge investments, including spending on education, the share of education spending in the GDP, and spending on research and development, among other things, in both advanced and developing nations (Kabanda, 2013). The Internet/global penetration rate, which may be gauged by the number of fixed line and internet customers as well as the global competitiveness index, is another statistic for gauging knowledge economy success. It has been acknowledged that the internet penetration/global partnership rating is a strategic rating (Kuerová, 2021).

Zakaria (2021) pointed out that knowledge economy performance measures include: a) information and communication technology indexes like telephone fixed line users per 1000 people, computers per 1000 inhabitants, and Internet users/subscribers per 1000 population; b) innovation and technology indexes like applications for patents and trademarks and the number of scientific papers; and c) education and human resources indexes like average years of education, secondary enrolment, and tertiary enrollment. The "quality of education" element, however, is particularly significant in supporting human capital development in market economies with severe rivalry and a potential influence on knowledge and innovation in sectors (Chatterji & Kiran, 2017; Kuèerová, 2021).

The quality of education refers to offering each student the ideal circumstances for a full and fruitful growth, much as the term "quality" "represents the sum of the qualities and features of a product or service that bears its potential to meet expressed or inferred demands" (Bano & Taylor, 2015). The effectiveness of procedures and the caliber of the educational services offered serve as metrics for evaluating the quality of education or educational institutions in an economy (Leila & Djilali, 2014). Indicators used to assess it include the number of students, professors, schools/colleges, the teacher-to-student ratio, and output approach indicators like the percentage of students who pass exams at a certain educational level, among others (Kuerová, 2021). As an example, Algeria's education system mandates 10 years of formal education (Belimane & Chahed, 2021).

Children typically attend primary school for five years, from ages six to 11, followed by middle (or lower-secondary) school for the last four years, until they reach the age of 15, after one year of early education (Bouzid, Berrouche, & Berkane, 2013). Citizens of Algeria are entitled to free elementary and intermediate school education, and attendance is required. After that, children may enroll in secondary school for three years to get their high school diploma (Baccalauréat de l'Enseignement Secondaire), which is necessary to enroll in higher education (Touitou, Yacine, & Ahmed, 2020). In recent years, improved educational opportunities and standards have contributed to Algeria's improving literacy rates (Wissam & Amina, 2022). According to the most recent statistics, 81 percent of adults and 97 percent of children are literate. In 2020, Algeria had roughly 1.5 million students enrolled in higher education (Conto et al., 2020).

Over a third of the pupils were women, who made up the bulk of the students (Zahia, 2018). In fact, women had a greater gross enrolment rate in tertiary education than men did, with the average reaching 52.5 percent in 2020 (Wissam & Amina, 2022). Among Algerian university students, the most common academic disciplines of study are business administration, law, the arts, and the humanities. In contrast, the lowest percentage of graduates has degrees in veterinary, forestry, and agricultural fields (Belimane & Chahed, 2021). Higher education degree holders have the highest unemployment rate in the nation among all educational levels (Zahia, 2018). All of these cast doubt on Algeria's educational system's effectiveness and its bearing on the country's knowledge-based economy.

For instance, institutions of higher learning should be seen as teaching and learning organizations that must provide high-quality outputs with skills and knowledge appropriate for the job market (Leila & Djilali, 2014). Quality schools train specialists in particular fields with the assistance of professors and other teachers, guarantee the transfer of skills to graduates, encourage basic and applied scientific research and widen the horizon of human knowledge, and facilitate the transfer of skills in socio-economic institutions (Wissam and Amina, 2022). Moreover, they do this via the engagement of the academic community in society, which results in the direct transfer of talents to local, regional, national, and worldwide communities in diverse economies, such as Algeria (Hamdan et al., 2020).

2. Literature Review

In reaction to the claims made by exogenous theorists, endogenous growth, or the new growth theory, developed in the 1980s, especially as a result of the work of Paul Romer and his collaborators (Braunerhjelm, Acs, Audretsch, & Carlsson, 2010). They claimed that the majority of fast-growing economies, especially those in East Asian emerging nations where the economy has been growing for more than three decades, showed just the opposite (Monteils, 2002). The idea is that there are additional elements that are beyond the purview of the neoclassical growth model that are responsible for sustaining such large growth performances in knowledge-driven countries, rather than only technology (Howitt, 2010).

The new growth model observes that technological development has not been uniform or exogenously transmitted in the majority of emerging nations, in contrast to the Solow model, which views it as an exogenous force (Monteils, 2002). Theorists of new growth connected knowledge creation with technical transformation (Monteils, 2002; Howitt, 2010). The new growth paradigm stresses that growing returns to the application of information, rather than labor and capital, drive economic progress (Braunerhjelm et al., 2010). According to the hypothesis, an economy or company that invests in physical capital would be better equipped to utilize its capital and technology since it would have educated, talented, and healthy employees. For example, if it hires professors (Setterfield, 2013), This will result in a "neutral" change in the production function, and hence, returns on investments may increase rather than decrease. This suggests that the system is endogenous to both technology and human capital (Monimah, 2010).

The fundamental premise of the endogenous growth theory is that changes in policy may affect an economy's long-term growth rate. It contends that by boosting the incentive to innovate, investments in education, school construction, research, and development enhance the growth rate. For instance, Acs and Sanders (2021) highlighted two drivers of economic development, namely the accumulation of human capital as a result of expenditures in education and the advancement of technology as a result of learning-by-doing externalities (Monimah, 2010). In other words, learning via experience and education enhances the expertise of employees in the manufacturing industry.

Also, according to proponents of the endogenous theory, research and development (R&D) are essential to the expansion and improvement of an economy or a business (Monteils, 2002). New concepts or innovations that are not widely used in society are produced through research and development. When a particular production process undergoes a technological transition, people with more education or superior abilities embrace the new technology more quickly (Howitt, 2010). Theorists also contend that society's human resources must be trained if it is to advance and flourish. Once managers (or workers) get training, Aharonovitz (2007) observed that they will become leaders of production units and train further managers who would, in turn, head additional production units or find new businesses and teach even more administrators (Setterfield, 2013).

This process will be ongoing and result in development and progress (Acs and Sanders, 2021). Long-term development will result from this since new businesses provide employment, which lowers poverty and raises the level of life in society (Roberts & Setterfield, 2007). The theory contends that lower levels of complementary expenditures in infrastructure, R&D, or human capital (education) seriously undermine the greater rate of returns predicted by the Solow model (R&D). However, because of its potential for limitless growth, knowledge differs from other economic assets. Reuse of information or innovations is free. So, investments in knowledge generation might result in long-term growth. Moreover, once acquired, the knowledge might result in advantages for other businesses. Markets, however, were unable to generate enough new information since people are unable to fully profit from the creation of new knowledge via their own investments.

Building a knowledge economy requires a strong, adaptable education system (Acs and Sanders, 2021). Basic education lays the groundwork for learning; secondary and tertiary education develops key competencies and abilities and stimulates critical and creative thinking to support innovation in order for a knowledge economy to be established (Roberts & Setterfield, 2007). In order to achieve the knowledge economy and thereafter progress, there must be a pool of educated human resources in the sciences and technologies (Kuerová, 2021).

The rapid generation of knowledge workers and knowledge societies, even with the revolution in information and communication technology, is a key feature of globalization (Firth & Mellor, 2000). According to studies, universities in particular are higher education institutions (HEIs) that produce knowledge with the goal of equipping future generations with the necessary abilities, scientific literacy, adaptability, and capacity for scientific enquiry and inventions that would have a lasting effect on society (Bouzid et al., 2013; Bano & Taylor, 2015; Kuèerová, 2021). As higher education institutions are engaged in knowledge generation, distribution, and learning, they are referred to as being in the "knowledge business" (Roberts & Setterfield, 2007). Considering their purpose and goal, higher education institutions must contribute to giving their nations a competitive edge (Masoud, 2014).

Several studies have been conducted on the impact of quality education on the knowledge economy (Nurunnabi, 2017; Chatterji & Kiran, 2017). Many systematic discussions of previous literature found that quality education was an important component needed to promote human capital for growth and sustainable growth in the knowledge economy (Glewwe, Maiga, & Zheng, 2014; Bloom, Canning, Chan, & Luca, 2014). Furthermore, many studies have also examined the impact of various variables of interest on the knowledge economy. Some of these variables include: the impact of entrepreneurship on the knowledge economy in Africa (Asongu & Tchamyou, 2016), innovative development and human capital (Podra, Litvin, Zhyvko, Kopytko, & Kukharska, 2020), mobile phones in the diffusion process (Asongu & Nwachukwu, 2016), the impact of universities (Bano & Taylor, 2015), higher education in Vietnam (Tran, Marginson, Do, Le, Nguyen, Nguyen, Nguyen, Vu, & Pham, 2016), and the transformation from an oil-based economy (Nurunnabi, 2017), Based on methodologies, approaches, and indicators, several studies have made use of indicators like the Global Innovation Index (Podra, Litvin, Zhyvko, Kopytko, & Kukharska, 2020), econometric approaches like structural equation modeling (Chatterji & Kiran, 2017), panel data structured analysis such as the System Generalized Method of Moments (Oluwatobi, Olurinola, Alege, & Ogundipe, 2020), and dynamic panel analysis (Phale, Li, Adjei Mensah All the studies found that the knowledge economy was affected by various factors, including technology integration, quality of schooling, and human capital quality over time (Glewwe, Maiga, & Zheng, 2014; Nurunnabi, 2017; Chatterji, & Kiran, 2017).

From the foregoing, a few studies have been carried out on the quality of education and knowledge economy in various parts of Africa and other developing nations on other continents. However, many of them made use of indicators like the global innovation index (Podra et al., 2020) and investment in education and R & D (Nurunnabi, 2017; Chatterji & Kiran, 2017). Hence, internet penetration indicators like the number of fixed line subscribers and the number of internet subscribers are rarely considered in most investigations. This is a knowledge gap in literature. Furthermore, studies on education quality and knowledge economy in Algeria often make use of Granger causality equations (Leila & Djilali, 2014; Hamdan, Sarea, Khamis, & Anasweh, 2020) and rarely make use of fixed and random effect modeling with recent panel data covering a cross section of provinces in the state. This study sought to fill this gap in the literature.

Objectives

The aim of this investigation is to access the impact of quality of education on a knowledge economy with focus on Algeria. The specific objectives are to:

1) examine the impact of quality of education on a knowledge economy (number of fixed line subscribers) in Algeria
2) investigate the impact of quality of education on a knowledge economy (number of internet subscribers) in Algeria

Research Questions

The following guiding research questions was used in this investigation

1) What is the impact of quality of education on a knowledge economy (number of fixed line subscribers) in Algeria?
2) What is the impact of quality of education on a knowledge economy (number of internet subscribers) in Algeria?

3. Methodology

3.1. Research Design

The analysis of the data and techniques required to achieve study fit is known as research design. Also, it involves setting up circumstances and analyzing data in a way that combines relevance to reach a study goal (Saunders, Lewis, & Thornhill, 2003). As a result, research designs are often categorized based on the sort of study or the nature of the research aims. For this study, the ex-post facto research design was used. The ex-post facto research design, according to Salvatore and Reagle (2002), aims to ascertain the causal link between a dependent and one or more independent variables. Another name for them is explanatory studies. In order to ascertain the causal link between one or more independent factors (education quality indicators) and a dependent variable (indicators of knowledge economy) in Algeria, the ex-post facto study design was used.

3.2. Data Sources and Description

The data used for this investigation are secondary data collected from Algerian statistical indicators(The Ministry of Education, Algeria Telecom Headquarter). The data was a panel data set, having both cross-sectional and annual time series components. The cross-sectional component covers 48 provinces, while the time span covers 1999 to 2020 (22 years): The specific data used as indicators of quality of education include: the number of students (NOS), which measures the head count of all students; the number of professors (NPRF), representing the cardinal number of qualified specialized teachers available to teachers at the tertiary level for human capacity development; the number of groups (NGRP); the number of high schools (NHS), representing the total number of post-secondary teaching institutions; The success rate of the baccalaureate examination (BAC) is the proportional percentage rate of students that pass the baccalaureate examination each year, while the intermediate exam success rate (BEM) is the proportional percentage rate of students that pass the intermediate examination each year. The dependent variable, which is knowledge economy, was measured with two proxy indicators, namely, the number of fixed line subscribers (NFLS) and the number of internet subscribers (NINS).

3.3. Estimation Techniques and Model Specification

This study performed regression analysis using a fixed-effects model and a random-effects model. With a panel dataset, which is a collection of data with cross-sectionals of i and temporal components of t, Bell, Fairbrother, and Jones (2019) pointed out that the fixed and random effect model is a strategy used to fit the sample of observations in the dataset in the best straight line possible. The cross-sectional components of I are the several provinces, each of which has its own unique institutional and environmental characteristics. The time component reflects the period of time from 1999 to 2022. The Hausman test was used to choose the best model from the fixed and random effect models. In a panel data study, this Hausman test assisted in identifying the model that fits the data the best. The two equations that need to be estimated are given in the following econometric forms:

$$NFLS = \alpha_0 + \alpha_1 NOS + \alpha_2 NPRF + \alpha_3 NGRP + \alpha_4 NHS + \alpha_5 BAC + \alpha_6 BEM + e_i \quad (1)$$

$$NINS = \beta_0 + \beta_1 NOS + \beta_2 NPRF + \beta_3 NGRP + \beta_4 NHS + \beta_5 BAC + \beta_6 BEM + e_i \quad (2)$$

Where:

By a priori expectation, the coefficients of number of students (NOS), number of professors (NPRF), number of groups (NGRP), number of high schools (NHS), success rate of the baccalaureate examination (BAC), and intermediate exam success rate (BEM) are all expected to be greater than zero. That is, have a positive relationship with the dependent variables represented by the number of fixed line subscribers (NFLS) and the number of internet subscribers (NINS). This implies that an increase in investment in education would promote education quality based on the endogenous growth theory. α_0 and β_0 are Constants of the equations, β_1, β_2, β_3, β_4, β_5 and β_6 are all coefficients to be estimated, ***i*** represents the cross sectional components (the 48 individually homogenous provinces), ***t*** represent the time span (1999 - 2020) while ***e*** is the disturbance or error term.

4. Results

The series were checked for unit root before processing to approximate the equation. With regard to the observation years, this is done to guarantee that the series remain stationary throughout each cross section (province) (1999 to 2020). Failure to perform this test might provide an erroneous result, making the regression estimate inaccurate for prediction, forecasting, and making policy recommendations (Pesaran, 2012). Levi, Lin & Chu t, Augmented Dickey Fuller (ADF) Fisher Chi square, and Philip Perron Fisher are some of the panel unit root tests that were used. The three panel unit root tests were run in order to determine if the series was stationary.

Table 1. Panel Unit Root test on the Variables

Variables	**Panel Unit rot tests**			**Order of Integration**
	Levi, Lin & Chu test	**ADF-Fisher Chi square**	**PP-Fisher Chi-square**	
NFLS	-3.4735 (0.0003)**	180.237 (0.000)**	314.225 (0.0209)*	*I*(0)
NINS	-14.0637 (0.0000)**	115.421 (0.0862)	266.599 (0.0000)**	*I*(1)
NOS	-4.0567 (1.0000)	214.408 (0.0000)**	412.701 (0.0000)**	*I*(1)
NPRF	-0.8088 (0.2093)	129.004 (0.0139*	275.224 (0.0000)**	*I*(1)
NGRP	-2.3017 (0.9893)	215.993 (0.0000)**	1408.99 (0.0000)**	*I*(1)
NHS	-7.4502 (0.0000)**	291.389 (0.0000)**	558.100 (0.0000)**	*I*(1)
BAC	-4.3665 (0.0000)**	157.646 (0.0001)**	387.251 (0.0000)**	*I*(0)
BEM	-3.1907 (0.0007)**	146.635 (0.0007)**	157.101 (0.0001)**	*I*(0)

Note: *** variables are significant at 0.01 level of significance (p<0.01). * Variables is significant at 0.05 level of significance (p<0.05)*

Source: Regression result from (EViews version 7).

Findings from Table 1 showed that NINS, NOS, NPRF, NGRP, and NHS were stationary at first differencing, or integrated at order one I, whereas NFLS, BAC, and BEM were stationary at level, or integrated at order zero I(0) (1). The null hypothesis that there are no unit roots was thus preserved for NFLS, BAC, and BEM but rejected for the remaining series, NINS, NOS, NPRF, NGRP, and NHS. In addition to being required to rule out any unit root issues, the test for stationary state of the variables is a prerequisite for calculating the series' and equations' long-term effects (Pesaran, 2012). The Kao (Engle Ganger based) Cointegration Test was used to ascertain the long-run connection among the series prior to calculating the equation. Table 2 displays the outcome.

Table 2. Kao (Engle Ganger based) Cointegration Test for the Series' long-run relationship

*Series: **NFLS** NOS NPRF NGRP NHS BAC BEM*	**t-Statistic**	**Prob.**
ADF	-4.8165	0.0000
Residual variance	21985202	
HAC variance	21060520	
*Series: **NINS** NOS NPRF NGRP NHS BAC BEM*	**t-Statistic**	**Prob.**
ADF	-5.5657	0.0000
Residual variance	22323442	
HAC variance	23995360	

Source: Regression result from (EViews version 7).

The data in Table 2 reveals that the augmented dickey fuller's (ADF) t-statistics (-4.8165 and -5.5657) are both statistically significant (prob < 0.05). The null hypothesis that there was no cointegration was therefore rejected. This shows that the series has at least one co-integrating vector. This further suggests that, over time, rising educational standards and expansion of the information sector tend to go hand in hand. As a consequence, this finding supports the notion that the knowledge economy and measures of educational quality have a long-term link. By applying the Panel Least Square (PLS), Fixed Effect (FE), and Random Effect (RE) regression models to estimate the regression equation, the long-existence run's was further extended. Table 2 gives the outcomes of the models.

Table 3. Regression Analysis on Model Equation 1

Variables	**PLS model**	**Fixed effect model**	**Random effect model**
C	-2903.745 (0.5535)	16682.3 (0.0000)	12960.26 (0.0010)
NOS	1.1873** (0.0000)	0.5194** (0.0000)	0.6655** (0.0000)
NPRF	-83.7648** (0.0000)	8.0221** (0.0005)	9.6250** (0.0000)
NGRP	10.936 (0.1137)	1.1996 0.5442	0.8965 (0.6502)
NHS	2259.237** (0.0000)	153.787 (0.0974)	119.152 (0.1946)
BAC	-151.839 (0.1671)	154.897** (0.0000)	158.33** (0.0000)
BEM	-301.937** (0.0002)	78.494** (0.0019)	53.551* (0.033)
Actual R^2	0.8279	0.9881	0.5012
Adjusted R^2	0.8266	0.9873	0.4975
F-statistics	648.720** (0.0000)	1200.532** (0.0000)	135.493** (0.0000)
Durbin –Watson (DW) statistics	0.1383	0.4731	0.3869
Hausman test = 177.3510** P-value (0.0000)			

Dependent variable: NFLS (Number of fixed line subscribers).
Note: * Coefficient is significant at 0.05 level of significance (p<0.05). ** Coefficient is significant at 0.01 level of significance (p<0.01) p-value of each coefficient in parenthesis.

Source: Regression result from (EViews version 7).

There are three different kinds of model equations in Table 3: PLS, fixed, and random effect models. Panel least square, which approximated equations by simple pooling of data, may not be sufficient due to the inherent weakness of homogeneity issues and individual individuality connected with cross-sections such as the provinces in this research. In order to make this assessment, this research solely takes fixed or random impact modeling into consideration. The Hausman test was used to determine the model that suited the data the best for interpretation, estimation, and forecasting. The random effect model is the most suitable one for the regression estimate, according to the null hypothesis of the Hausman test. The fixed effect model is thus suitable since the null hypothesis was rejected. The Hausman test coefficient (177.3510) from Table 3 is statistically significant (p-value = 0.0000). The fixed effect model is the one that best accounts for shifting patterns in the knowledge economy (number of fixed line subscribers), since the null hypothesis was rejected as a result.

The NOS, NPRF, BAC, and BEM coefficients were all positive and statistically significant (p 0.01) in the fixed effect model. This shows how an increase in any one variable by one unit would result in roughly equal growth in the knowledge economy (number of fixed-line subscribers) by each projected coefficient's magnitude. The knowledge economy would grow by around 0.52 and 8.02 percent, respectively, for every 1% increase in the number of students and professors, according to the coefficients of 0.5194 and 8.0221 for NOS and NPROF, for example. All of the variables in the fixed effect model had positively signed coefficients, which is consistent with the theoretical expectation based on the endogenous theory and suggests that a rise in any of the independent variables corresponds with an increase in the dependent variable. The variables (NOS, NPRF, NGRP, NHS, BAC, and BEM) together account for 98.7 to 98.8 percent of fluctuations in the number of fixed-line subscribers, according to the modified R2 and actual R2, which determined the quality of fit of the model. Similar to this, the fixed effect model's F-statistic (F = 1200.532) demonstrated that the coefficients collectively affect the knowledge economy (p = 0.0000).

Table 4. Regression Analysis on Model Equation 2

Variables	**PLS Model**	**Fixed effectmodel**	**Random effect model**
C	-36853.14* (0.0354)	-24589.11 (0.6806)	-79118.34** (0.0001)
NOS	1.0082 (0.1797)	0.4217 (0.6369)	0.7148 (0.3571)
NPRF	-7.4044 (0.6263)	-56.2973 (0.2381)	-12.6236 (0.5164)
NGRP	-7.9692 (0.5517)	2.9738 0.8060	0.6752* (0.9544)
NHS	318.054 (0.4777)	619.978 (0.6003)	481.640 (0.4702)
BAC	1004.169** (0.0082)	1996.66** (0.0000)	1569.891** (0.0001)
BEM	-299.108 (0.1866)	860.077** (0.004)	587.919** (0.0052)
Actual R^2	0.1046	0.4932	0.1168
Adjusted R^2	0.0903	0.4118	0.1027
F-statistics	7.3435 (0.0000)	6.0584 (0.0000)	8.3099 (0.0000)
Durbin –Watson (DW) statistics	0.3155	0.6498	0.5145
Hausman test = 12.7114* P-value (0.0479)			

Dependent variable: NINS (Number of Internet Subscribers).

Note: * Estimate is significant at 0.05 level of significance ($p<0.05$). ** Estimate is significant at 0.01 level of significance ($p<0.01$) p-value of each coefficient in parenthesis.

Source: Regression result from (EViews version 7).

PLS, fixed, and random effect models are the three kinds of model equations shown in Table 4. Panel least square, which estimated equations by combining data in a simple way, might not be a good choice because of the problems with homogeneity and individuality that come with cross-sections like the provinces in this study. This research only looks at fixed or random impact modeling because that's the only way to make this estimate work.The Hausman test was used to determine the model that suited the data the best for interpretation, estimation, and forecasting. The random effect model is the most suitable one for the regression estimate, according to the null hypothesis of the Hausman test. The fixed effect model is therefore suitable since the null hypothesis was rejected. The Hausman test coefficient (12.7114) from Table 3 is statistically significant (p-value = 0.0000). The fixed effect model is the most effective at explaining shifting patterns in the knowledge economy (number of internet users), since the null hypothesis was rejected as a result.

Only the positive and statistically significant ($p<0.01$), BAC (1996.66) and BEM (860.08) coefficients in the fixed effect model had an influence on the total number of internet customers. This explains why an increase in any of the variables by a percentage would result in a comparable rise of 1996.66 and BEM 860.08 percent in the knowledge economy (number of internet users) by about the magnitude of each predicted coefficient. All of the fixed effect model's coefficients, with the exception of one (NPRF), were positively signed, which suggests that an increase in any of the independent variables correlates with an increase in the dependent variable. This is consistent with the theoretical expectation based on the endogenous theory. The variables (NOS, NPRF, NGRP, NHS, BAC, and BEM) together explain 41.18 to 49.32 percent of changes in the number of internet users, according to the adjusted R^2 and actual R^2, which indicated the goodness of fit of the model. Similar to this, the fixed effect model's F-statistic (F = 6.0584) revealed that the coefficients collectively affect the knowledge economy (p = 0.0000).

5. Discussion/Conclusion

In a knowledge economy, the importance of human capital development cannot be understated. This was well shown in this study, as the knowledge economy was encouraged by a rise in student success rates on baccalaureate and intermediate exams. This agrees with findings from previous studies like those of Leila and Djilali (2014) and Hamdan, Sarea, Khamis, and Anasweh (2020), who both found that quality education promoted knowledge and innovation in the real sector of the economy. This result may be due to the fact that a rise in exam success rates indicates that individuals at various educational levels are now receiving education of a higher caliber, and the economy depends on this caliber of education. The rise in students and professors is a sign that there are more knowledgeable people and specialized educators accessible to fuel the knowledge economy. As more educated citizens pass their exams and graduate from college, they are hired from the labor market into industries as significant production factors whose skills, values, and knowledge acquired through specialized training are expected to promote machine handling and coordination of other human and nonhuman production factors to fuel the knowledge economy.

6. Recommendations

In light of the results, the following recommendations have been provided:

1) The recommendations of the United Nations Educational, Scientific, and Cultural Organization (UNESCO) pointed that the government should try to put 26% of the country's gross domestic product (GDP) toward improving the education sector. This money should be used to build good high schools and hire qualified professors for universities so that research and development can move forward and help the knowledge economy.

2) Teachers should be given access to ongoing professional development opportunities to help them provide instruction at all educational levels. This would improve their ability to educate and inspire students and help them do better on their intermediate and baccalaureate exams. To make it easier for academics and instructors to participate, the training should take the form of full-time training programs, conferences, workshops, and sandwich courses.

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