RESEARCH ARTICLE

AN APPLICATION OF REGRESSION ANALYSIS TO HUMAN CAPITAL DEVELOPMENT IN KATSINA STATE

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ARTICLE INFO	ABSTRACT
	In this research work, data consisting number of pupils enrolment in primary schools, number of students enrolment in secondary schools, number of successful candidates, number of failure candidates, capital expenditure, recurrent expenditure covering 2002-2011 was obtained and analyzed to identify the level of educational achievement recorded under democratic dispensation, using Regression analysis. The result shows a weak correlation between Students performances and capital expenditure and other factors like students teacher ratio, teaching and learning aid, Poor Staff welfare and about 60% of the students are failing their examinations while 40% have the minimum requirement of entry into higher institutions of learning. This is achieved by using T- test. The study concludes that the use of regression analysis provides a suitable tool for assessing the level of education.

INTRODUCTION

In statistics, regression analysis includes many techniques for modeling and analyzing several variables, when the focus is on the relationship between a dependent variable and one or more independent variables. More specifically, regression analysis helps one understand how the typical value of the dependent variable changes when any one of the independent variables is varied, while the other independent variables are held fixed. Most commonly, regression analysis estimates the conditional expectation of the dependent variable given the independent variables. Regression analysis is widely used for prediction and forecasting, where its use has substantial overlap with the field of machine learning. Regression analysis is also used to understand which among the independent variables are related to the dependent variable, and to explore the forms of these relationships. In restricted circumstances, regression analysis can be used to infer causal relationships between the independent and dependent variables. However this can lead to illusions or false relationships, so caution is advisable (Armstrong, 2012).

A large body of techniques for carrying out regression analysis has been developed. Familiar methods such as linear regression and ordinary least squares regression are parametric, in that the regression function is defined in terms of a finite number of unknown parameters that are estimated from the data. Nonparametric regression refers to techniques that allow the regression function to lie in a specified set of functions, which may be infinite-dimensional. The performance of regression analysis methods in practice depends on the form of the data generating process, and how it relates to the regression

approach being used. Since the true form of the data-generating process is generally not known, regression analysis often depends to some extent on making assumptions about this process. These assumptions are sometimes testable if a large amount of data is available. Regression models for prediction are often useful even when the assumptions are moderately violated, although they may not perform optimally. However, in many applications, especially with small effects or questions of causality based on observational data, regression methods give misleading results (Dennis *et al.,* 1982; David, 2005). The earliest form of regression was the method of least squares (French: *méthode des moindres carrés*). In their study (Legendre, 1805 and Gauss, 1809) both applied the method to the problem of determining, from astronomical observations, the orbits of bodies about the Sun. Gauss (1821) published a further extension of the theory of least squares including a version of the Gauss–Markov theorem.

In the 1950s and 1960s, economists used electromechanical desk calculators to calculate regressions. Before 1970, it sometimes took up to 24 hours to receive the result from one regression (Ramcharan, 2011). Regression methods continue to be an area of active research. In recent decades, new methods have been developed for robust regression, regression involving correlated responses such as time series and growth curves, regression in which the predictor or response variables are curves, images, graphs, or other complex data objects, regression methods accommodating various types of missing data, nonparametric regression, Bayesian methods for regression, regression in which the predictor variables are measured with error, regression with more predictor variables than observations, and causal inference with regression. The notion of investment in human capital is of recent origin. Jhingan (2005) points out that in the process of economic

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growth, it is customary to attach importance to the accumulation of physical capital than human capital, the new endogenous growth theories are thus significant in the introduction of the active role of human capital in the growth of economies. Human capital is the term economist often use for education and other human capacities that can raise productivity when increased. According to Todaro and Smith (2003) education is too closely related to human capital components that makes the individual more productive. Appleton and Teal (1998) describe education as a component as different from their types of good produced in societies. Nigeria, which was one of the richest countries in the early 1970s has retrogressed to become one of the 25th poorest countries at threshold of the twenty-first century. The belief to human capital as a necessity to growth started in Nigeria during the implementation of the 1955-1960 development plans and today, with the importance of knowledge in the economy, human capital has increasingly attracted both academic and public interest.

In Nigeria most of the problems with education system are low public spending by government, poor infrastructure and facilities in public institution, poor packages for personnel and poor performances of students, most especially in Senior Secondary Examinations. Another problem with Nigerian education is its failure to account for a growing gap between peoples increasing learning efforts and knowledge base and the diminishing number of commensurate jobs to apply their increasing knowledge investment, especially in educationally developing states. This study examines the role of education in human capital development in Katsina.

It is expected that the result of this research work will:

- Assist the ministry of education to take some measures that will minimize the failure performance in primary, secondary and tertiary schools.
- Assist the ministry of education, state government and other organizations concerned like Mathematical Improvement Project (MIP), put hands together for the re-training of teachers especially Mathematics and English Language.
- Assist the ministry of education to embark on policies that will focus on the eradication of massive failure in the senior secondary certificate examinations (S.S.C.E).
- Be benefits to academic environment and potential research in similar works.

Research Hypothesis

The following hypotheses are stated for this research work:

- H0: There is no positive relationship between education expenditure and students performance in Katsina State.
- H1: There is positive relationship between education expenditure and students performance in Katsina State.

Study Area

Katsina state was carved from Kaduna state in 1987. It is now made up of 34 local government areas with three senatorial zones. The state is located in the north western part of Nigeria. It's bordered with Niger Republic to the north, Kano state to the south, Kaduna state to the south west, Jigawa to the east,

Sokoto and Zamfara state to the west. The native people are predominantly Hausa and Fulani. Islam is the inhabitants' major religion, while few among them are Christian. The population of the state was estimated to be 6,483,429 in 2005 (en.wikipedia.org/wiki/Katina state). The main economic activities of the people in katsina state are small scale farming and food processing. Informal trading and other micro-entrepreneurs are playing a crucial role in their economic life (www.katsinastate.gov.ng). Only few of them work as civil servant.

MATERIALS AND METHODS

Regression models

Regression models involve the following variables:

- The unknown parameters denoted as β; this may be a scalar or a vector.
- The independent variables, X.
- The dependent variable, *Y*.

In various fields of application, different terminologies are used in place of dependent and independent variables. A regression model relates *Y* to a function of X and β.

$$Y \approx f(\mathbf{X}, \boldsymbol{\beta})$$

. The approximation is usually formalized as $E(Y \mid X) = f(X, \beta)$. To carry out regression analysis, the form of the function *f* must be specified. Sometimes the form of this function is based on knowledge about the relationship between *Y* and X that does not rely on the data. If no such knowledge is available, a flexible or convenient form for *f* is chosen. Assume now that the vector of unknown parameters β is of length *k*. In order to perform a regression analysis the user must provide information about the dependent variable *Y*:

- If *N* data points of the form (*Y*,X) are observed, where $N < k$, most classical approaches to regression analysis cannot be performed: since the system of equations defining the regression model is underdetermined, there is not enough data to recover β.
- If exactly $N = k$ data points are observed, and the function *f* is linear, the equations $Y = f(X, \beta)$ can be solved exactly rather than approximately. This reduces to solving a set of *N* equations with *N* unknowns (the elements of β), which has a unique solution as long as the X are linearly independent. If *f* is nonlinear, a solution may not exist, or many solutions may exist.
- The most common situation is where $N > k$ data points are observed. In this case, there is enough information in the data to estimate a unique value for β that best fits the data in some sense, and the regression model when applied to the data can be viewed as an overdetermined system in β.

In the last case, the regression analysis provides the tools for:

1. Finding a solution for unknown parameters β that will, minimize the distance between the measured and predicted values of the dependent variable *Y* (also known as method of least squares).
2. Under certain statistical assumptions, the regression analysis uses the surplus of information to provide

statistical information about the unknown parameters β and predicted values of the dependent variable Y.

Regression Diagnostics

Once a regression model has been constructed, it is important to confirm the goodness of fit of the model and the statistical significance of the estimated parameters. Commonly used checks of goodness of fit include the R-squared, analyses of the pattern of residuals and hypothesis testing. Statistical significance can be checked by F-test of the overall fit or by t-tests of individual parameters. Ordinary least squire (OLS) model was used to estimate the parameter of the model. One of the prerequisite for using OLS is that there is no linear relationship among the explanatory variables i.e. it assumes away multicolinearity. If multicolinearity is present it will be difficult to extract the individual influence of the predictant. Being capital and recurrent expenditure as well as primary and secondary enrolment possess common similarities, thus they will be analyse in form of partial regression. We used SPSS 16.0 as our analysis tool.

Variables measurement

The following variables will be measured in model

Dependent variable: Number of student performance is used as a dependent variable, students with higher institution entry qualifications were measured as a proxy to students' performance.

Independent variables

Primary school enrolment: number of pupils enrolled into primary school.
Secondary school enrolment: number of student admitted to secondary school.
Capital expenditure: amount of money envisaged on project with long life expectancy.
Recurrent expenditure: all expenditure for maintaining the school including salary and wages of the staff.

Model Specification

The model is specify below:

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \varepsilon$$

Where:
Y = Students performance
X_1 = Pupils enrolment in primary school
X_2 = Students enrolment in secondary school
X_3 = Number of successful candidates
X_4 = Number of failure candidates
X_5 = Capital expenditure
X_6 = Recurrent expenditure

The model indicates the influence of independent variables over the dependent variable.

Data Analysis and Discussions

Partial regression was run using SPSS to analyse the influence of primary school enrollment, secondary school enrollment, capital expenditure on education and recurrent expenditure on education against students' performances. The results were presented in the tables below.

Table 1. Model Summary of PEPS and NSC

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.640	.410	.337	4499.6731

Predictors: (Constant), PEPS

The r^2 is 0.410 shows that approximately 40% variation in students' performance in their WASSCE and NECO is explained by number of pupils enrolled in the primary school. The parameter of primary school enrolment is positive and significant at 5% level of significance. And finally the model is adequate at even 1% level of significance.

Table 2. Model Summary of SESS and NSC

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.562	.316	.230	4846.3626

Predictors: (Constant), SESS

In secondary school enrollment it indicates a weak relationship, because our r^2 value was very low. This shows that other factors like students teacher ratio, teaching and learning aid exert more in influence than the number of students enrolled in secondary school. The parameter of secondary school enrollment is positive and significant. The model is also adequate.

Table 3. Model Summary of CE and NSC

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.143	.021	-.102	5798.8663

Predictors: (Constant), CE

The influence of capital expenditure on student performance was very low. The result indicates a weak correlation between student performance and capital expenditure. This is so because most secondary school more especially in rural areas students were sitting on the floor, class congestion etc.

Table 4. Model Summary of RE and NSC

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.609	.371	.292	4648.0886

Predictors: (Constant), RE

Unlike capital expenditure, the parameter of recurrent expenditure is significant at 10% level of significance and the model is adequate. The r^2 value was low indicating the low relationship between the variables. Poor staffs' salary as well as high student-teacher ratio may be the reasons for menace in the state. The most striking aspect of this research indicates that approximately 60% of students enrolled in secondary schools finished their school without requirements to further their studies.

T-Test

Table 5. Paired Samples Statistics of SESS and NFC

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	SESS	1.3997	10	6134.4223	1939.8746
	NFC	9.0399	10	5482.4084	1733.6897

Table 6: Paired Samples Correlations of SESS and NFC

		N	Correlation	Sig.
Pair 1	SESS & NFC	10	.553	.098

Tables 5 and 6 presents the T-test Paired Samples Statistics and Correlations of students' enrollment in Secondary Schools and number of failure Candidates in West African examination council result and national examination council of Nigeria result.

Hypothesis Testing

We reject H0 and accept H1 and conclude that there is positive relationship between education expenditure and students performance.

SUMMARY OF RESULTS

Table 7. Model Summary of PEPS, SESS, CE and RE against NSC

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.640	.410	.337	4499.6731
2	.562	.316	.230	4846.3626
3	.143	.021	-.102	5798.8663
4	.609	.371	.292	4648.0886

Table 7 presents the summary of Partial regression of primary school enrollment, students enrollment in secondary schools, capital expenditure on education and recurrent expenditure on education against the number of successful candidates in west African examination council result and national examination council of Nigeria result.

Conclusion

The results of the study show that about 60% of the students are failing their examinations and 40% have the minimum requirement of entry into higher institutions of learning. And we noted that there are inadequacies of funding, half-hazard plans and poor commitment of policy makers to education.

Recommendation

Katsina State is confronted by most of the problems that could limit the capacity of expansion in education to stimulate growth and development such as under-employment, low absorptive capacity, shortage of professionals and brain-drain. The persistence of many of the problems in spite of the various policy formulation and responses points to the need for a more focused, responsive, functional and qualitative education system. To contribute significantly to economic growth and development, education must be of high quality and also meet the skill-demand needs of the economy. To accumulate high quality human capital, necessary to make Katsina State sustain its population, compete favourable with other parts of the nation and the world in general, education should consider the following issues:

i. The leaders should give a listening ear, and a committed heart to education.
ii. Funding and alternative ways of funding education need to be addressed urgently.
iii. Advocating for a suitable standard as in other parts of the world with good educational standard.
iv. Education should be globalized to be able to compete with other nations of the world.

v. Teaching and learning equipment should be made available for education to be effective.
vi. The government need to harness all the resources for education of its citizens; giving at least 45% of annual budget to education.

Above all, Katsina State needs the government that is able to tackle the education challenges.

Abbreviations

PEPS : Pupils enrolment in primary school
SESS : Students enrolment in secondary school
NSC : Number of successful candidates
NFC : Number of failure candidates
CE : Capital expenditure
RE : Recurrent expenditure

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