EFFECT OF GOVERNMENT EXPENDITURE ON THE PERFORMANCE OF PUBLIC PRIMARY SCHOOLS IN KENYA

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DECLARATION

This Thesis is my original work and has not been presented for a degree in any other University or for any other award.

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To my parents Annah and Jackson, my wife Gladys and my Children Mark, and Precious, Sharon, Joan and Mark for their moral support, empowerment, and prayers, that have made this long journey a success.

ACKNOWLEDGEMENT

I am significantly obligated to the Almighty God for conceding me the chance and wellbeing to create and compose this proposal. I might want to offer my thanks to my proposition directors, Dr. Diana Ngui-Muchai, Ph.D. and Dr. Julius Korir, Ph.D. whose help, mastery, understanding, and patience were basic in the advancement and conclusion of this, added extensively to the improvement of this postulation. The scholarly remarks and steady help have made this proposition a triumph. I am additionally profoundly obliged to my cohorts in 2009 colleagues including Prof. Maurice Ogada, Dr. Makali Mulu, Dr. Maurice Ombok, Dr. James Karau, Dr. Kennedy Ocharo, Frederick Owiti, Charles Nyadenge, Maina Mutuaruhiu, and Herman Mwangi. The support got and remarks went far in the advancement of this proposal. At last, I wish to express gratitude toward Kenyatta University for the honor of this degree.

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ABBREVIATIONS AND ACRONYMS

AE	Allocative Efficiency
BDF	Budget Deficit Proxies
BLUE	Best Linear Unbiased Estimates
CES	Constant Elasticity to Scale
CEX	Capital Expenditure
CRS	Constant Returns to Scale
CRSTE	Constant Returns to Scale Technical Efficiency
DEA	Data Envelopment Analysis
DRS	Decreasing Returns to Scale
EFA	Education for All
FE	Fixed Effect
FPE	Free Primary Education
GDP	Gross Domestic Product
GER	Gross Enrolment Ratio
GLM	Generalized Linear Model
GNP	Gross National Product
IQ	Intelligence Quotient
IRS	Increasing Returns to Scale
JICA	Japan International Cooperation Agency
KCPE	Kenya Certificate of Primary Education
KCSE	Kenya Certificate of Secondary Education
KICD	Kenya Institute of Curriculum Development
MALP	Monitoring Learning Achievement in Lower Primary

MDGs	Millennium Development Goals
MOE	Ministry of Education
NACECE	National Centre for Early Childhood Education
OLS	Ordinary Least Squares
POP	Population
PTAs	Parents Teachers Association
PTE	Pure Technological Efficiency
RE	Random Effect
SACMEQ	South African Consortium for Monitoring Education Quality
SAPs	Structural Adjustment Programmes
SDGs	Sustainable Development Goals
SE	Scale Efficiency
SFA	Stochastic Frontier Analysis
TE	Technical Efficiency
TEC	Technical Efficiency Change
TEE	Total Economic Efficiency
TFP	Total Factor Productivity
TSLS	Two Stage Least Squares
UPE	Universal Primary Education
UNESCO	United Nations Education, Scientific and Cultural Organization
VRS	Variable Returns to Scale
VRSTE	Variable Returns to Scale Technical Efficiency

OPERATIONAL DEFINITION OF TERMS

Education Enrolment: This is the deliberate access of household ensuring children join either public or private schools for purposes of learning. The level of access involves pupils in class one to eight

Education Quality: This is the perceived outcome explained by achievements acquired by a pupil after completion of a given level of education. It is also explained by scores attained in arithmetic and comprehension.

Efficiency The is the level of performance that describes a process that uses the lowest amount of inputs to achieve the highest amount of outputs

Government Expenditure: The amount allocated, disbursed and utilized by the government to primary schools in Kenya. The amount covers administrative, recurrent and development expenditure provided for as a capitation on an individual pupil enrolled in public primary schools.

Gross Enrolment: Total enrolment in primary education, regardless of age, expressed as a percentage of the eligible official primary school-age population in a given school year

Net Enrolment:	Number of learners in primary education within the school-age going group expressed as a percentage of the corresponding population
Primary Education:	This is the elementary level of school education level regarded as the first stage of complementary education from class one to class eight, under the 8-4-4; and Grade 1-grade 6 in the 2-6-3-3-3 education framework.
Primary School:	This is the location within which basic formal education takes place. They can either be government-owned (public school) or privately owned (private school).
Productivity	A measure of the efficiency in a school achieved through converting inputs into expected outputs. It is computed through dividing the average output per period by the total inputs invested and decomposed into Pure Efficiency Change, Technological Change and Scale Efficiency Change.
Technical Efficiency:	This is the level where the outcomes for enrolment and quality of education are optimal after utilizing the constrained inputs in the school.
Technological Change	This is the increase in an index of the quantity of output per unit of input. It explains the change in the production function parameter

School Performance: This is described by school outcomes explained by enrolment levels, quality of education and school Productivity.

School Access The ability of the pupils to get enrolled in a school either in private or public schools

Utility This is the satisfaction derived by a parent and a pupil from the achievement resulting from the choice of a given school by a parent and achieving a given score in assessment by the pupil respectively.

School Possession Index: This is a comparison of the relative utilities in a given school compared to the school enrolment levels as per standard government requirement

ABSTRACT

The government of Kenya has increased budgetary allocation to the education sector in its effort to achieve universal primary education and in line with the Social Pillar of Vision 2030 and global Sustainable Development Goal number four of Universal Primary Education. The budget allocation increased from 6.2 percent of Gross Domestic Product in 2002/03 to 7.4 percent in 2005/06. It, however, dropped to 5.3 percent in 2014/15 and further to 5.24 in 2017/18. As a result, Gross Enrolment Rate rose to 104 percent in 2003 from 92 percent in 2002 and rising further to 105.3 percent in 2017. As a consequence, class-pupil, and teacher-pupil ratio increased from 36:1 and 42:1 to 45:1 and 57:1 between 2002/03 and 2012/03 and further 42:1 and 55:1 in 2017, respectively. Despite the increased enrolment, the quality of education and technical efficiency levels in schools were compromised even with the positive changes in government expenditure on education were positive. Teachers concentrated more on the examination classes to boost Kenya Certificate of Primary Education results at the expense of skill acquisition in arithmetic and comprehension across all classes. Although the free primary education had shown remarkable milestones in enrolment rates, its impact on education quality and technical efficiency levels had not been assessed. Therefore, using the level of enrolment, quality of education and technical efficiency indicators to explain school performance, this study analyzed the relationship between government expenditure on education and educational outcomes. The study was guided by three objectives that involved: establishment of the effect of government expenditure on enrolment in public primary schools in Kenya; determination of the effect of government expenditure on the quality of education in public primary schools in Kenya; and measurement of the contribution of government expenditure to levels of technical efficiency in public primary schools within 47 counties in Kenya. School enrolments and class six scores were used as outcome variables. Technical Efficiency scores in the study were used to test and determine optimal utilization of school resources including government expenditures. The study used data collected from the class six scores undertook by the South and Eastern African Consortium for Monitoring Education Quality nation-wide surveys of 2000, 2004, and 2012. More data was collected from the Kenya National Examination Council and Statistical Abstracts between 1997-2018. To achieve the first two objectives, the study used fixed-effect models. For objective three, the study combined Data Envelopment Analysis with Two-Stage Least Squares regression. Results from the study showed that government expenditure and school attributes were positive for enrolment and quality of education. Further, technical efficiency had improved in all the regions by 2012. The efficiency levels were influenced by school facilities, school location, and level of government funding. The study noted the need for the government to increase its overall expenditure allocated on education to serve as a catalyst for enhancing and improving overall school performance in Kenya's public primary schools. Moreover, the bulk of the allocated resources ought to be dedicated to the development and improvement of school facilities and equipment.

CHAPTER ONE

INTRODUCTION

1.1 Background

Human capital formation has been identified as a conscious framework that is continuous with the aim of acquiring and increasing the share of population with the required education, knowledge, experience and skills and (Hanushek & Woessmann, 2012; Javed, 2013; Hanushek, 2013; Tsamadias & Prontzas, 2012; Franzini & Raitano, 2014). The degree of information procured is an urgent necessity for the financial, social and political advancement for some random nation (Manafi and Marinescu, 2013; Mehmet and Sezer, 2014; Sunde, 2017). Further, human capital development prompts an expansion in per capita national Gross National Product (GNP), which diminishes levels of accumulated poverty and support towards increased knowledge acquisition in an environment that has reduced levels of inequality (Yildirim, Deniz & Hepsag, 2011; Franzini & Raitano, 2014; Owusu-Nantwi, 2015; Sunde, 2017; Baqaee & Farhi, 2018). There exists an expansion in enthusiasm within direct investment and related potential interest in education as for expected profits for technical efficiency within a learning situation as clear in the fundamental work on the human capital advancement (Lucas, 2002; Joshi, 2006; Yildirim et al., 2011; Jiang, Shi, Zhang and Ji, 2011; Vijesandiran and Vinayagathasan, 2015).

In line with Claudia (2001), Hanushek and Woessmann (2012), and Franzini and Raitano (2014), education is identified as a key determinant to overall economic well-being which can be achieved through various mechanisms.

One of the mechanisms that countries can adopt is the increment in anticipated human capital, which is characteristically in the process of labor utilization, subsequently an expansion in labor productivity. Further, the productivity increment assists trigger with output equilibrium level that results in upgraded levels of school enrolment, education quality and levels of productivity within the neoclassical development theory (Bosworth and Collins, 2003; Dutt, 2011; Jiang et al., 2011; Shiozawa, 2016). On the side of the theory featured by the neoclassical economist's analysis expanded economic levels improve an of the economy towards new information, creativity, on developing items, procedures and advances, henceforth advancing absolute economic development (Mercan & Sezer, 2014; Dutt, 2011; Franzini & Rainato, 2014; Tsamadias & Prontzas, 2012).

Thus, the correlation between expected results on education takes awareness of school enrollment, school technical efficiency and education quality which explains the levels of school performance. (Hanushek and Woessmann, 2012). The indicators of performance expected in a school are certain and critical on estimating quantitative degrees of economic growth and education benefits which are encouraged by both family unit uses and government expenditure within schools (Krueger and Lindahl, 2001; Temple, 2001; Sianesi &Van Reenen, 2003; Javed, 2013; Bosupeng, 2015; Mallick and Dash, 2015, Mallick, Das and Pradhan, 2016).

Further, a few studies built up that results from primary school are reliant on family unit attributes, level of enrolment and school type, levels and financing methods towards education within the stipulated government policies

(Republic of Kenya, 2017). The results accomplished are adjusted to national targets and government strategies with respect to school performance (Mazar, Ariery & Shampanier, 2007; Cohen & Dupas, 2010; Bold, Kimenyi, Mwabu & Sanderfur, 2011; Douanla & Abomo, 2015). In Kenya, the government policies that support school performance at the primary education system characterized training as both a private and public good as credited by its interest. The strategies, subsequently, make opportunities the government to give a contributory factor to the public primary education where non-rival and non-excludable advantages apparent to the overall public are remarkable (World Bank, 2010; Republic of Kenya, 2012; 2017).

1.1.1 Policy Evolution Guiding Kenya's Primary Education

The goal to accomplish quality essential training in Kenya is exhibited by how students' take an interest in the social, political and the environment of the well-being of households. It is additionally targets creating independence and self – articulation towards an all-round involvement with an instructive setting for students (World Bank, 2010; Republic of Kenya, 2012; 2017). The strategy outcomes determined are hence limited to students' performance, science, and comprehension, which is assessed through the Kenya Certificate of Primary Education (KCPE). The assessment is embraced in class eight toward the end of primary levels of education. Given the assessment procedure, KCPE results have been utilized as a reason for progress in secondary schools. The KCPE examination was additionally utilized as a proportion of school performance. In spite of the fact that KCPE assessment has been regularly applied to measure of performance of primary school, different instruments that were completely considered to decide performance of schools considered levels of

development for enrolment within schools and technical efficiency in schools which are examined in this study (Vos, Bedi, Kimalu, Manda, Nafula and Kimenyi, 2004; Republic of Kenya, 2012; De Witte and Kortelainen, 2013; Cordero-Ferrera, Santín and Simancas, 2015).

The additions made in school performance because of the different changes were recorded through sessional papers and advisory groups' reports which featured the requirement for improved quality of education, increased school enrolment in primary, and enhanced technical efficiency in schools. These three indicators were recognized as key major challenges to be examined and clarify school performance in basic education for a given country (Bedi, Kimalu, Kulundu and Nafula, 2002; Mazar et al., 2007; Bold et al., 2011; Cohen and Dupas, 2010; Kimalu, Nafula, Kulundu, Bedi, Mwabu and Kimenyi, 2001).

In Kenya, the commissions and audits archived guided school changes and included; 1964, Ominde Commission report and the Gachathi Report of 1979. The Ominde report prescribed the appropriation of the 7-4-2-3 training system and the inclusion of new subjects including history and geography that would reinforce national character and solidarity. Moreover, in 1979, the Gachathi Report suggested the change of printing and distribution industry from that was increasingly externally possessed to local ownership and printing with a point of distributing books that coordinated social needs that were versatile to the Kenyan system of education. The commission made suggestions that came about into government financing for network Harambee schools and further

prompted the foundation of the National Center for Early Childhood Education (NACECE) at the Kenya Institute of Curriculum Development (KICD).

The Presidential Working Group known as the Markay commission in 1981, prescribed the Establishment of the Second Public University, and further suggested advancement of the new educational system planned for expanding examinable subjects in schools from three to eleven. The commission likewise suggested the requirement for more emphasis and assessment on science and practical oriented subjects in the educational plan. The extra prescribed subjects expanded the quantity of new reading material and related books utilized in schools. This prompted the development of Kenya's printing industry. Therefore, the suggestions made by the commissions' directed to the introduction of the 8-4-4 system of education prompted significant instruction audits of partners including distributors, providers, and development partners into dynamic interest.

The Presidential Working Taskforce on Education and Manpower Training for the Next Decade in 1988 analyzed the informal sector contribution to the further development of managers and artisans. The team prescribed that certification is presented as part of the assessment, and evaluations for craftsmen just as the extension of technical institutions and polytechnics. Further, the government developed the sessional paper no.1 of 2005 which concentrated on Education for All (EFA) accomplishment and, Universal Primary Education (UPE) specifically. The key concerns in the sessional paper were retention, access, quality, equity, and relevance as well as external and

internal and efficiencies within the system of education. Further, the legislature through an Education Task Force report in 2012 proposed another educational system of education identified as 2-6-3-3-3 that would replace the 8-4-4 curriculum of education (Republic of Kenya, 2005; 2007; 2012). The 2-6-6-3 education framework was rolled out in 2017/18 underlining level of efficiency and quality of education which would exceptionally benefit from the results of this study (Republic of Kenya, 2012).

The policy approach changes recognized by the commissions and committees examined focused on components of overseeing gaps identified with UPE and EFA which influenced the expected school performance targeting 100 percent Gross Enrolment Rate (GER) and high levels of quality of education. In order to mitigate these gaps, the government introduced Free Primary Education (FPE) in 2003 geared towards fast-tracking the number 2 of Millennium Development Goals (MDG), the number 4 of Sustainable Development Goal (SDG) and furthermore accomplish 100 percent (UPE) for the school-going populace. Further, the FPE utilization additionally included financing from the government which took care of expenses for development projects, school operational functions, and acquisition of instructional materials. The government expenditure was under the capitation charge of Kenya Shillings 1,020 out of 2003 for each pupil per annum and this increased to Kenya shillings 1,200 per annum of every pupil in 2010 (Republic of Kenya, 2017b).

As indicated by studies carried out Bold et al., (2011) and Bold, Kimenyi, Mwabu, Ng'ang'a, and Sandefur, (2013) the capitation procedure may have

prompted some school headteachers to provide higher enrolment figures which lead to budgetary irregularities in allocations for public primary schools within the time of implementing the FPE program just as after the program stabilized. Amazingly, after the FPE introduction, different studies discussing the enrolment levels against school performance were embraced. The outcomes from these investigations found very little was done to establish the extent of government expenditure impact on other school performance indicators especially the education quality and levels of technical efficiency. In spite of proof of a causal relationship among policies and enrolment, the levels of enrolment were just straightforwardly tended to by the strategies and related policies (Keller, 2006; Gime'nez, Prior and Thieme, 2007; Thieme, Gime'nez and Prior, 2012; De Witte and Kortelainen, 2013; Santín and Sicilia, 2014; Cordero-Ferrera et al., 2015).

Also, more analysis on school performance that was attempted laid out the correlation between's FPE, the quantifiable and non-direct effect of the individual strategy and policy on education. Prominently, these gaps were not been completely tended to through the attempted investigations particularly in the education quality of and levels of technical efficiency. Also, policy analysts were worried about the utilization of available resources during policy execution. The worry was resulting from the set number of studies on technical efficiency within schools that would clarify how expected output was accomplished from school inputs. The investigations noticed that, if more studies were provided, investigation on technical efficiency would give the levels of optimal and effective use of resources allocated in public primary

education (Portela and Thanassoulis, 2001; Mazar, Ariery and Shampanier, 2007; Bold et al., (2011); Cohen and Dupas, 2010; Woessmann, 2016; Johnes, Portela, and Thanassoulis, 2017).

1.1.2 The Trends Applied in Financing of Public Primary Education in Kenya

The government financing model for the primary level of education started in the 1970s through the community-based financing mechanism referred to as the *Harambee* which was applicable for pupils in standard one to standard four. Thereafter, the community-based financing mechanism for education was implemented following the cost-sharing mechanism which was put in place during the time of Structural Adjustment Program (SAPs) period which was during the 1980s. Remarkably, the cost-sharing system necessitated that households to contribute a sum of 35 percent in expenses of school expenditures expected to finance primary education covering improvement, development projects and operational projects in schools (Republic of Kenya, 2005; 2017; World Bank, 2010; Bold et al., 2013). During this period, the mechanism of cost-sharing expanded the costs of education hence leading to low levels of enrollment, increased levels of dropouts, low completion rates, poor progression/transition rates which led to high-grade repetition. These low rates resulted in high inefficiency levels in the school resource utilization within educational institutions (Kimalu et al., 2001; Bedi et al., 2002; Bold et al., 2013; Santín and Sicilia, 2014). To address the negative impacts resulting from the cost-sharing system of financing activities in schools, the government introduced the Free Primary Education (FPE) program where resources/finances were sent straightforwardly to schools accounts based on

capitation levels (Government of Kenya, 2007; Bold et al., 2013; Onderi and Makori, 2014).

An analysis of the expenditure trends by the government towards primary education in Kenya previously, during and after the introduction of FPE found that capitation portions to schools demonstrated remarkable effects. The remarkable effects observed included a positive increment for the government expenditures that was a cost-sharing supplement and was upheld by the Parents Teachers Associations (PTA's) management. A further perception included systematization and institutionalization of the combined financing framework consolidating both government allocation and contributions by family units' to education resulting in the expansion of resources mobilized as well as checking school enrollment levels and education quality (Bold et al., 2013; Republic of Kenya, 2017). These perceptions identified were encouraged towards realization when the government rolled out the FPE program in 2003.

The investigation on the procedure of utilization of government allocation to primary education indicated that prohibition of PTAs in the indirect administration of financial resources in schools prompted a next to zero feelings of possession by the significant partners thus bringing about a more fragile oversight job. Thus, the government allocation for primary education was sent directly to the school's bank accounts. To address PTAs low confidence, an amended management structure that held PTAs oversight role in development projects was created. This oversight role prompted

responsibility from heads of school and furthermore guaranteeing reducing quality of education due to lack of modalities of managing the zero-cost in tuition fees. The reduction of tuition fees increased demand for education, which led to increase in enrollment hence low education quality. The deterioration in quality of education had adverse effects on FPE when untended to. However, the government was geared towards UPE accomplishment through its expenditure on the education sector (Mazar et al., 2007; UNESCO, 2010; Bold et al., 2013; Republic of Kenya, 2013; Orodho, 2014).

To encourage the financing system for the UPE, the government spending plan designated to schools through the Ministry of Education was determined dependent on the per capita estimation of the National Gross Domestic Product (GDP). The calculation demonstrated that there existed an increasing trend in the budget allocation to the Education Ministry. The expenditures from the resources allocated Ministry of Education were dispensed as assistance for the accomplishment of targets outlined in national policies (Bold et al., 2013; Republic of Kenya, 2005; 2013; 2017). Further, changes in resource allocation to the Ministry of Education, growth of schools and allocation made to primary school education level between 1996/97 and 2017/18 were calculated and presented in **Figure 1.1**.

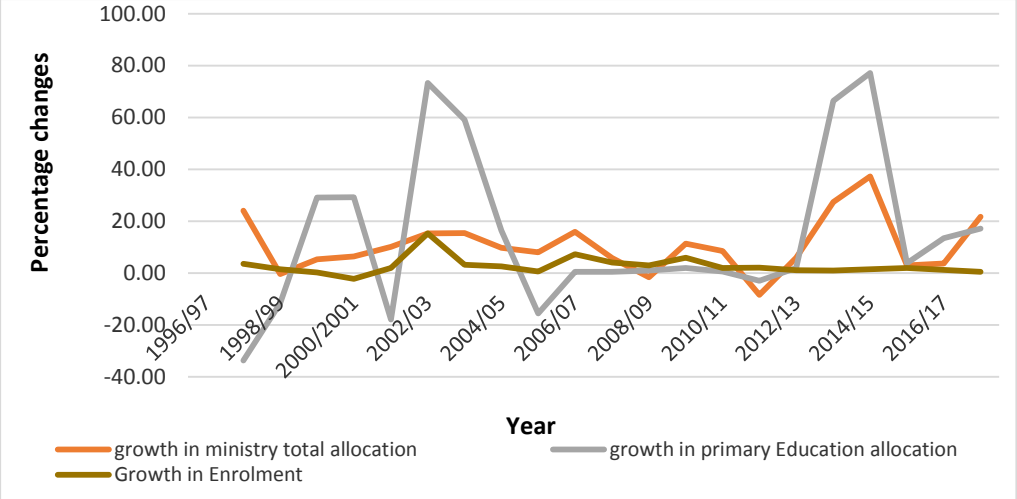

Figure 1.1: The Percentage growth of Allocation to the Ministry of Education, Allocation to Primary Education allocation and levels of School Enrolment;
Source of Data: Statistical Abstracts, 2005; 2010; 2017

Government allocation levels displayed in Figure 1.1 indicated trends in changes in the level of provision in budgetary allocations to the Ministry of Education. It additionally demonstrated further payment to primary education and the portions of allocations made were in contrast with enrolment growth in primary schools between 1997/98 and 2014/15. The outcomes displayed in Figure 1.1 demonstrated that, between 1997/98 and 1998/99, budgetary allocations made to the Ministry of Education decreased by 31.55 percent, however, the expenditures on primary education were increased by 25 percent at the same period. The analysis additionally shows that there was an increase in school enrolment from 2.00 to 3.62 percent during the same period. The decrease in budgetary allocation between 1997/98 and 1998/99 was attributed to the economic performance that declined in 1996 during the execution of Structural Adjustment Programs (SAPs). The economic growth was additionally staggered notwithstanding changes in macroeconomic

programmes in the country. The low economic reaction to development by the growth trends prompted shocks resulting from low interest in the private investment which further added to low returns (World Bank, 2010, Hornby, 2007; Mallick and Dash, 2015; Republic of Kenya, 2017). Accordingly, deteriorating levels of investment influenced all divisions of the economy including the education sector which prompted the government to introduce an appropriation resource given towards stimulating enrolment in schools which was a sign for positive growth in access to schooling.

In 2002/03 enrolment in schools varied hardly by 2.04 percent while government budgetary allocation to the Ministry of Education became expanded at a rate of 5.5 percent, 6.85 percent, and 11.2 percent in 1999/2000 to 2001/2002 respectively. The growth in budget allocation by the government to primary education additionally decreased to a low of 10.44 percent in 1999/2000 and further by 15.16 percent in 2001/2002. Changes in allocation to schools were experienced at a period in which Kenya accomplished high expenditure ratio to GDP at 26.5 percent between 1997/98 and 2002/2003. The proportions of expenditures included development expenditure at (3.7 percent) and recurrent expenditure at (22.7 percent) during the period.

To finance the education sector within domestic resources, alterations on government financing frameworks that prompted a decrease in resources for education among other service sectors were made (Russell, 2012; Javed, 2013; Republic of Kenya, 2017). Given the pattern, a notable increment towards the Ministry of Education in spending was decidedly expanding which was

additionally reflected at an increased allocation to primary education until the year 2000, followed by a drop in 2001/2002. Notwithstanding the positive increment in budgetary allocation to both the primary education system and the Ministry of Education and, levels of enrollment in primary schools decreased to 1.51 percent, 0.23 percent and - 2.24 percent between 1999/2000 and 2001/2002 respectively.

The FPE introduction in 2002/2003 resulted in a growth in budgetary allocation by the government skewed towards the Ministry of Education. The allocation increased by 17.96 percent in 2002/2003 and further 18.26 percent in 2003/2004 respectively. The government allocation later dropped by 10.8 percent in 2004/2005 respectively. Regardless of the budgetary allocation changes, the resources assigned to the Ministry of Education which further tricked to primary education increased by 275.22 percent in 2002/2003 yet later diminished by 144.37 in 2003/2004 and a further low of 19.55 percent in 2004/2005 respectively.

The enrolment growth as showed increased by 2.04 percent in 2002/2003. It further increased by 18.09 percent in 2003/2004 and later dropped by 3.29 percent in 2004/2005 respectively. With the increase in enrolments within school, the sustainability of UPE targets were not ready to be accomplished hence the government needed to identify an alternative mechanisms of financing that would help the accomplishment of national targets including 100 percent school enrolment, highest levels of education quality and technical efficiency in schools (Republic of Kenya, 2005; 2010; 2017).

Between 2005/2006, budget allocation to the Education Ministry grew by 8.64 percent and further 18.91 percent in 2006/2007. The growth dropped by 1.58 percent because of the post-election violence in 2007/2008. The budgetary allocation growth towards the primary system of education additionally dropped by 13.5 percent in 2005/2006 and increased by 67.5 percent in 2006/2007 respectively. Likewise, primary education allocation patterns showed that there was a decrease in government allocation by 10.18 percent in 2008/2009. Comparing allocation by the government to education levels in the period the analysis demonstrated a positive growth in enrolment that increased to 7.82 percent in 2007/2008 during a period when households were displaced during the post-election violence in the country. There was high habitation in schools thus expanded enrolment to their school by the children of households taking refuge in schools.

1.1.3 Analysis of Primary Schools Performance in Kenya

A reference to strategies and policies created by different committees and commissions and gave in section 1.1.1 noticed the longing for improved Kenya's primary schools' performance (Republic of Kenya, 2005; 2007; 2012; 2017). The indicators of performance given in the approaches and policies involved aspects related to; improvement school enrolment level, improved education quality and optimization in the utilization of the available resources that could lead to a high level of technical efficiency. Of significance, outstanding restrictions that identified levels of school performance were distinguished from past examinations that were dependent on large enrolment in schools and results in KCPE examinations (Kimalu et al, 2001; Nero, 2003;

Republic of Kenya, 2007; World Bank, 2010). Nonetheless, the examinations neglected conclusions that were authentic on the optimal performance of schools in a constrained condition where budget provision low existed from allocated resources.

Notwithstanding the suggestions made by the commissions and committees developing policies, the outcomes from KCPE assessments were utilized within the studies and thus became bias. The biasness resulted from the different levels of enrolment, the different resources allocated to education, which assumed high demand scores as well as different enrolment levels that pupils were prepared for. The variations in scores helped policymakers to comprehend government expenditure impact on the performance of school also discussed in Figure 1.1 (Kimalu et al, 2001; Nero, 2003; Republic of Kenya, 2007; World Bank, 2010; Tandi, 2013; Republic of Kenya, 2017). The indicators of performance in schools that were identified within the policies formed the study objectives; they included enrolment levels, education quality, and schools' technical efficiency.

1.1.4 Enrolment Levels in Primary School Education in Kenya

The dedication of the government to accomplish the UPE targets focused at 100 percent achievements and was adjusted to the different commissions, targets, and policies developed (Republic of Kenya, 2005; 2007; 2012). Within the policy alignment process and related procedures, the government provided annually budgetary allocations that were made to the primary system of education between 1997/98 and 2014/15. During this same period, there

was a decrease in enrolment levels for certain periods yet, in addition, recorded marginal growth through changes in the number of students selected every year aggregated in the primary school system which was fundamental for the accomplishment of UPE and strategy direction.

The growth in enrolment at school levels was a key indicator in education and could influence by and large school performance in the education sector. An analysis of class-pupil ratio and teacher-pupil ratio and as shown in **Figure 1.2**.

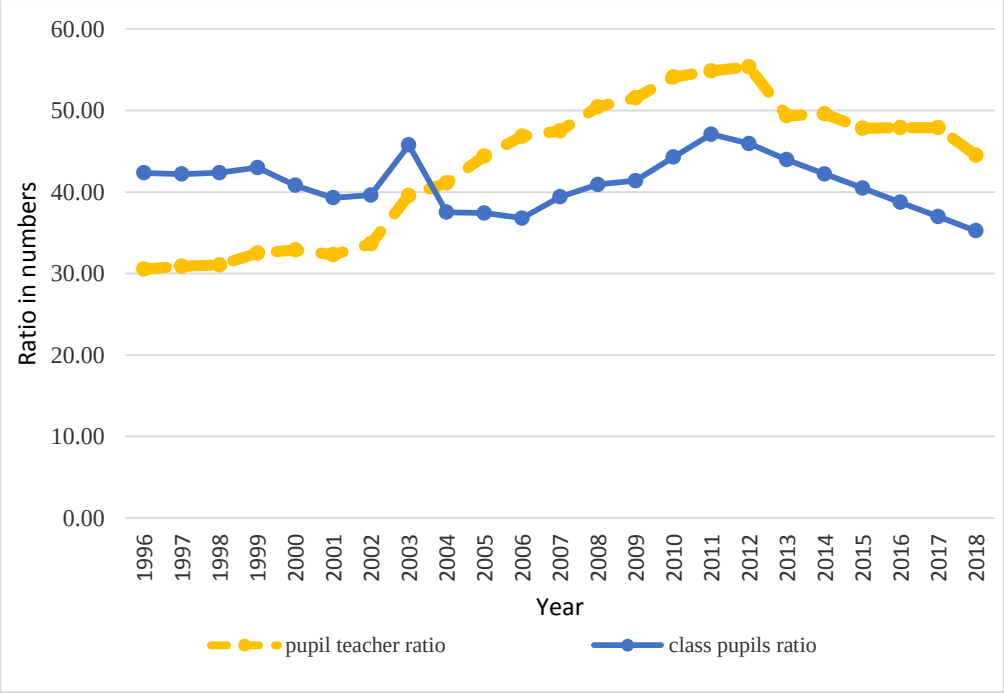

Figure 1.2: Pupil-Teacher and Pupil-Class Ratio Ratio
Source of data: Statistical Abstracts, 2005; 2010; 2012b; 2017

The presentation in figure 1.2 shows that the pupil-teacher- ratio increased from 32:1 in 1996 and further to 43:1 in 2003 and later 56:1 in 2012 a period when adjustment of the FPE program stabilized. The pupil-class- ratio increased in excess of 44 pupils for every class in 1997 and further to around

52 pupils in a class by 2003. These ratios were however balanced out as high as in excess of 42 pupils for each class in 2017. These proportions were, higher than the worldwide acknowledged standard of 31:1 and 36:1 for pupil-teacher and pupil-class ratio respectively. The allocation of the budget to primary education was not at standard with the infrastructure established to accommodate the increased levels of enrolment levels as reflected he increased pupil-class ratio that went from 43:1 in 1996 to 46:1 in 2003. As indicated by Muyanga, Olwande, Mueni, and Wambugu (2010), levels of enrolment in the lower classes, were as high as between 42 to 122 students, it was noticed that in certain periods, pupils would read under trees for certain regions. The situation was not in accordance with the government expenditure objective of educations just as the targets for UPE (Kim Jo and Park, 2016; Mukundi, 2004; Kimalu et al., 2001).

1.1.5 Education Quality in Primary Schools in Education

The national measures of quality of education were pegged on results for KCPE assessments for quite a while. This was according to the policies and strategies that outlined the performance of KCPE assessments as a pointer for school performance. (See Republic of Kenya, 2005; 2007; 2012a; 2017). The education quality was required to show positive patterns with expanded government expenditure on education in the wake of moving from a framework of government's cost-sharing mechanism of financing education to the FPE financing program for education. An investigation on the relationship between scores for KCPE assessments and the growth in candidature recognized that minimal changes were evident particularly when essential

training (KCPE) results were in contrast with the progressions in budgetary allocation by the government as clarified in Figure 1.3.

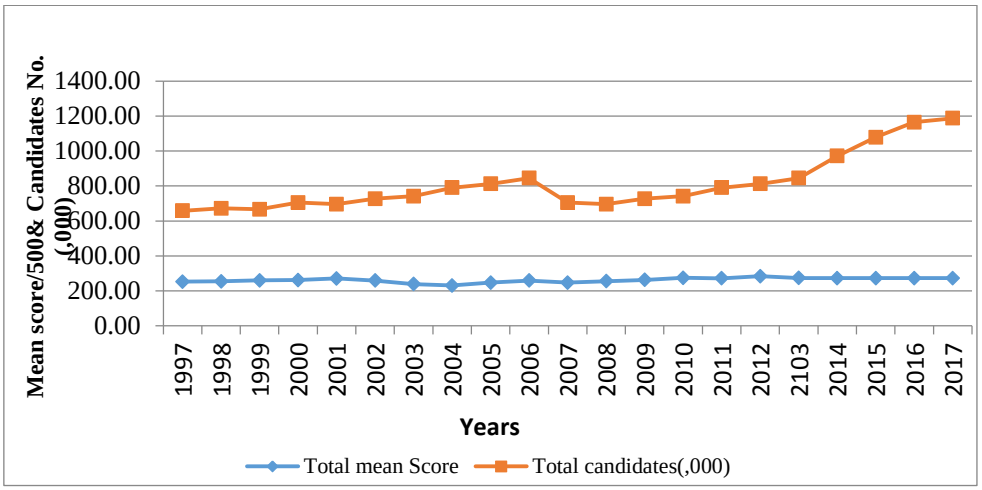

Figure 1.3: Number of Candidates in (, 000) and Total Mean for KCPE Scores and
Source of Data: Kenya National Examinations Council (KNEC), 2005; 2010; 2012; 2017

The presentation in **Figure 1.3** indicated that the number of candidates who sat for the KCPE examinations grew from 657,752 of every 1997 to 704,921 out of 2000 while the KCPE mean score emphatically changed from 254 to 263 and a decrease in KCPE mean scores by 0.77 percent between 1998/99 and 1999/2000. During the same period, insignificant changes in enrolment within schools were experienced in the levels of growth of government allocation for its budgets to the primary system of education increasing significantly as outlined in Figure 1.1. The decrease of mean scores in KCPE to 259 out of 2002, the government allocation towards primary schools likewise dropped by 17.93 percent while enrolment in schools increased. The number of candidates sitting for KCPE assessments grew by 2 and 4.5 percent between 1997 and 2002 separately. Further, the FPE implementation in 2003 noticed an expansion in KCPE candidature to 741,510 (6.17 percent); however, the mean scores for KCPE decreased to 238 (see Figure 1.3).

Outstandingly, the outcomes in Figure 1.1 demonstrated a drop in allocation by the government to the primary system of education from 272.22 percent to 19.55 percent and more to - 13.5 percent in 2004 and 2005. Further, during the same period, mean scores for KCPE assessment scores additionally decreased to 230 of every 2004 and thereafter improved to 248 in 2005. The school levels of enrolment grew by 2.59 percent while the candidature numbers increased to 843, 580 in 2006. Between 2007 and 2008, the candidature numbers decreased to 704, 922 and 695, 785. The drop in candidature was because of the displacements occasioned by the post-election violence. The mean score for KCPE assessments additionally diminished to 248 in 2007 but grew marginally until 2014, there was however a decrease in levels of school enrolment to 2.88 percent in 2008. This improvement was expected to the stabilized FPE programme of education including a stable political environment and economic growth.

The expansion in school enrolment had an impact on pupil-class and pupil-teacher ratio. The ratios built up a situation that could have been obliged teachers to convey deliver the curriculum dependent on result expectations. Accordingly, most schools opted to prepare pupils for KCPE assessments other than achieving the curriculum requirement (Republic of Kenya, 2005; 2012b; 2017)

The investigation displayed in Figures 1.1, 1.2 and 1.3 neglected to establish a framework relating the primary level of education, government expenditure

and expected enrolment growth expectation and conceivable mean scores for KCPE assessments. The investigation in Figure 1.3, further clarified that the mean scores for KCPE assessments were negligible throughout the years and in this way neglected to give the actual impact of government expenditure on the achieved education quality. In addition, Kimalu et al., (2001); Mukundi (2004); Muyanga, Olwande, Mueni and Wambugu (2010) found that the high pupil-class and high pupil-teacher ratios in public primary schools were utilized as for a purpose teachers to coach pupils for KCPE examination scores target. To deal with this inconsistency, two major independent assessments attempted in Kenya incorporate; the Monitoring Learning Achievement in Lower Primary (MALP) which was an appraisal focusing on pupils in class 2 and the South African and Eastern Consortium for Monitoring Education Quality (SAECMEQ) which was used for assessment to class 6 pupils. The SAECMEQ was embraced in 16 counties in Africa. The SAECMEQ scores were for comprehension and arithmetic in class 6. Currently, only three SAECMEQ appraisals have been attempted. The mean scores for the three appraisals displayed in Table 1.1. The Government of Kenya completed SACMEQ IV which had not been discharged during the time of this study, henceforth a data gap, which can be coordinated into further investigations.

Table 1.1: Class 6 Southern Africa Consortium for Monitoring Education Quality (SACMEQ) for 2000, 2004, 2008 and 2012.

Year	Name of Assessment	Mean scores/500 (Reading)	Mean scores/500 (Arithmetic)	Total pupils examined
2000	SACMEQ I	344.0	346.9	3,233
2004	SACMEQ II	346.5	353.9	3,296
2012	SACMEQ III	343.1	351.9	4,145

Source: SACMEQ, 2000; 2004; 2012

Table 1.4 demonstrated that the mean scores for SAECMEQ for class six pupils who were in both private and government-funded schools across over three time periods, 2000, 2004 and 2012 indicated negligible variations. The variations were experienced in spite of the different models of the primary education system which included the government and also households for public and private schools respectively. These variations were also evident despite the different levels of school enrolment in primary schools.

The utilization of scores for class 6 pupils under SAECMEQ assessment was progressively objective in giving an unmistakable measure education quality that could be utilized to explain the impact of government expenditure on the performance of primary schools. The contention on the utilization of scores for class 6 pupils was all-around discussed by Klee's (2008) and Musyoka (2013) who contended that any assessment attempted in a controlled domain, he outcomes are equally comparable the population of students despite the location of the school and the related difference in the various households. The discourse in this regard by Klees (2008); Musyoka (2003); and Gibson, Kitto, and Willis (2014), was that public primary schools situated in urban areas would obtain higher test scores on average than students in schools located in rural public primary schools.

1.1.6. Public Primary Schools Technical Efficiency in Kenya

Analysis of technical efficiency in schools assessed the degree of the utilization of resources in a school (Hanushek &Woessman, 2012). Technical efficiency additionally clarified how well the utilization of productive school

resources was accomplished through the most technologically, optimal and efficient way which suggested the presence of the highest possible factor output from a combination of a set of inputs (De Witte and Lopez-Torres, 2015; Sotiriadis, 2016; Johnes et al., 2017). For a procedure to decide the extent of school efficiency, significant results in educational inputs are considered and incorporate state-administered test scores in arithmetic and reading (Worthington, 2001; Santín and Sicilia, 2014; Cordero-Ferrera, et al., 2015).

In other related studies, school inputs that were utilized to clarify the determination of enrolment levels and quality of education were adopted for strategy survey, plan and advancement. Analysis by Kwabena and Appiah (2004) and Mizala and Rumaguera (2000) noticed that a portion of the inputs that are utilized to decide technical efficiency in school included teacher-pupil ratio, school type, school size, household's socio-economic levels, and geographical index. Further, Nyamoita (2013) in her investigation utilized socio-economic characteristics and household characteristics to establish levels of for public and private primary schools' technical efficiency in Kenya using data for the year, 2005. The study did not disaggregate data for private and public schools, thus each school type contribution to efficiency score at the county and national levels were not factored in the analysis.

However, further studies by Raposo and Menezes (2011); Kanina (2013); Cordero-Ferrera et al (2015); Baqaee and Farhi (2017), and Johnes, et al., (2017) identified the need to compare school efficiencies in different financing

framework within both controlled and uncontrolled environments. The studies further identified a gap in how public expenditure on education affected its outcomes, especially on-demand creation through enrolment and academic scores. With competing demands for government funding, it was important for education to be provided as efficiently as possible. Efficiency, therefore, occurred when outputs from an education programme (such as test results or scores for value addition) were produced at the least level of resource process (be it financial or, for example, the innate ability of students) in spite of macroeconomic shocks and their "pure" technology impact on allocative efficiency. The shock emerged from the related reallocation of resources and technical efficiency which could be estimated by means of changes in technological change.

In spite of the challenges education quality and enrolment resulting from the implementation of FPE given the increased allocation to education; the expenditure by the government has remained a significant contribution to deciding levels of technical efficiency in both private and state-funded schools' This result had not been determined throughout the years. The allocation of resources made to public primary schools could have affected other school inputs, for example, pupil-teacher ratio, infrastructure development, enrolment levels, and pupil-class ratio which were utilized to give the normal scores which are somewhat established in this study (Kwabena and Appiah, 2004; Mizala and Rumaguera, 2000; Nyamoita, 2013).

1.2 Statement of the problem

The government expectations and priorities on performance indicators in school within the primary education include levels of school enrolment, education quality and school technical efficiency facilitated through financing from either the government expenditure or households. The expectations were implemented through a set curriculum within school settings that were supported by policies and frameworks within the education sector (Republic of Kenya; 2005; 2007; 2012; 2017; Bold et al., 2011; Kimalu et al., 2001; Republic of Kenya, 2012). In its bid to improve primary school education, the government of Kenya has increased budgetary allocation to the education sector since 2003. Despite the increasing expenditures on education, enrolment rates at primary schools had not improved in line with the trends while the quality of education did not show any positive trends in its improved (Bold et al., 2011; Kimalu et al., 2001 and Muyanga et al., 2010; Republic of Kenya, 2017). Thus, it was necessary to assess the relationship between government expenditures on education and educational outcomes. Previous studies used school performance measures related to KCPE scores which could be biased due to drilling pupils in the examination classes, as well as examination cheating (Klees, 2008; Musyoka, 2013; Eggoh, Houeninvo & Sossou, 2015; Raheem, Isah & Adedeji, 2018).

This study analyzed the impact of positive increasing in government expenditure through Ministry of Education budgetary allocation to primary education on school performance and used the SACMEQ data which was collected targeting class six pupils whose scores were unbiased as the pupils

were perceived to be on a transition to KCPE examination preparation. In addition, scores for technical efficiency seemed not to relate within government expenditure variations to the education sector, a fact that may have compromised the optimal utilization of available resources and analyzed in this study (Kwabena & Appiah, 2004; Nyamoita, 2013). The analysis was based on three time periods that covered a period of education financing through cost-sharing framework for education in 2000; a period after the FPE implementation in 2004 and eight years after the FPE in 2012. The three periods, thus covered different levels of government expenditures to education (Bold et al., 2011; Kimalu et al., 2001; Mukundi 2004; Muyanga et al., 2010; Nyamoita, 2013; United Nations, 2013).

1.3 Research Questions

This study sought to answer the following listed study questions:

a. What is the effect of government expenditure on enrolment in public primary schools?

b. What is the effect of government expenditure on the quality of education in public primary schools?

c. What is the contribution of government expenditure on levels of technical efficiency in public primary education?

1.4 Objectives

The overall objective of this study was to establish the effect of government expenditure on public primary school performance in Kenya. The specific objectives were to:

a. Establish the effect of government expenditure on enrolment in public primary schools in Kenya.

b. Determine the effect of government expenditure on the quality of education in public primary schools in Kenya.

c. Determine the contribution of government expenditure to levels of technical efficiency in public primary schools in Kenya.

1.5 Significance of the Study

The need for policy formulation in enhancing the quality of education will necessitate policymakers to review results from this study especially with the implementation of the 2-6-3-3-3 curriculum and increased government expenditure in the education sector. The study outcome gave data that was sufficient to help the national strategies and policies looking to expand access to education through enrolment. Despite the fact that education quality was in the recent past was found to support schools situated within urban settings, the outcomes in this study gave an advisory to major stakeholders in the education sector on the environment where the performance of school was actualized.

This study further outlined the quality of education in different settings as a school performance outcome. This incorporated a situation where teachers trained students in anticipation of KCPE assessments. The need would be to finalize the policy requirement for curriculum development. Likewise, the study additionally outlined distinctive productivity levels that were ascribed to school inputs while taking into consideration of expenditures by the government. The study result additionally established a framework that was

clear towards skill acquisition. The acquisition was critical as Kenya change from the present 8-4-4 program of instruction to the 2-6-3-3-3 curriculum. (Republic of Kenya, 2005; 2007; 2017).

1.6 Scope and Organization of the Study

The study used data collected from the SACMEQ database for the years 2000, 2004 and 2012 and covered primary schools in the public domain sampled in 47 counties in Kenya represented by eight administrative regions as outlined in the Constitution of Kenya, 2010. The SACMEQ database covered class six pupils, who were perceived to have been tested in an unbiased environment, unlike the KCPE results where pupil assessment depended on levels of preparation to undertake the examination. The mechanisms of preparation, therefore, created a biased environment while determining levels of knowledge acquisition hence affecting the true value of the quality of education.

Notwithstanding levels of enrollment and education quality, schools' technical efficiency scores in past investigations contradicted their environmental and existing social-economic characteristics. These gaps were tended to utilizing the SAECMEQ – class six assessment system (Bold et al., 2011; Kimalu et al., 2001; Mukundi 2004; Muyanga et al., 2010; Nyamoita, 2013). This study, therefore, covered three-time frames which ware, the first period was before implementation of the FPE, and the second was immediately after FPE implementation, while the third was eight years after the stabilization of FPE. Further, time frames were different during data collections as they covered the

eight administrative regions comprising of all 47 counties as outlined in the constitution of Kenya, 2010.

The administrative areas that incorporated counties were missing in the studies on school performance previously undertaken. The studies relied on one period data although this study presented the data within county presentation (Otieno & Colough, 2009; United Nations Education, Scientific, and Cultural Organization, 2010; Bold et al., 2011; United Nations, 2013). In reference to the background information and related studies reviewed, an outstanding policy and strategy gaps were recognized in the estimation of the performance of schools. The estimations were interfered with by levels of biasness from the utilization of KCPE results, likewise, non-direct patterns in enrolment just as non-involvement of optimal utilization of resources. The outcomes in this study have given evidence on the overall impact of government expenditure on the performance of school supporting policy development, accountability, and improvement.

The study organization incorporates Chapter 1 that gives the background of the study, the research problem, research questions and research objectives of the study. It also provides justification for the study and overall paper organization. Chapter two presents hypothetical and theoretical literature n the various theories discussed. These include government expenditure theories, human capital development theories, and production theories. Previous studies that were reviewed under the empirical literature within the three theories were also presented

Chapter three depicts the strategy in the investigation. In the part, the three theories modeled. The chapter also discussed both the theoretical models and model specification in line with the three models and their relationship to government expenditure. Chapter four provides an analysis of the data provided. This includes summary statistics and data analysis undertaken through various analysis methods that include cross-section panel analysis to answer objective one and two. The Technical efficiency applied DEA to determine efficiency scores and related input and out changes. A censored Tobit model was also used to establish determinants of inefficiency from the DEA model. Chapter five highlights a summary of the study, study conclusions, areas of further research, and policy implications that were identified in the body of literature outlining the importance of government expenditure to education performance. Finally, the study provided key recommendations that would be adaptable to the education sector.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction to Literature

A theoretical and empirical review of the literature was provided in this chapter. It also discussed the theories that developed models that were related to the impact of government expenditure on education. The models outline the contribution of government expenditure on performance outcomes in education.

2.2 Theoretical Literature

Answering the research questions in the study will require identification and discussion of the various theories that explained the impact of expenditure by the government and performance of school These three theories are linked to school performance measures of which included school enrolment, education quality, and school technical efficiency. The literature reviewed indicated that, enrolment explained the demand levels for education and that parents enrolled their offsprings in a given school expecting quality education. This choice was arrived at through the level of acquired skills and knowledge. The knowledge acquisition levels were also based on the perspective that education was a public good that was best using government expenditure.

The adoption of the theory was, therefore, used to explain the impact of expenditure by the government on school enrolment as earlier discussed by neoclassical economists (Viscusi & Gayer, 2015; Zoran, 2015; Soydan & Bedir, 2015). Mostly, the previous studies had noted that the acquired knowledge in a given school was referred to as human capital which was best

explained by the human capital development theory. The theory was adopted for this study to help provide keen insight on the education quality as a means of measuring performance in schools (Javed, 2013; Bosupeng, 2015; Mallick & Dash, 2015, Vijesandiran & Vinayagathasan, 2015; Mallick et al., 2016; Raheem et al., 2018).

Further, an individual school would utilize efficiently the various school inputs provided to achieve the optimal and highest levels in relation to enrolment levels in school t, education quality, and levels of technical efficiency. In this case, the production theory was used for efficiency analysis framework (Carnoy, Loeb & Smith, 2001; Foley, 2003; Dolton, Marcenaro & Navarro, 2003; Glewwe & Kremer, 2006; Raposo & Menezes, 2011; Dutt, 2011; Baqaee & Farhi, 2017). The three theories were discussed independently but provided linkage to performance of school.

2.2.1 Government Expenditure Theories

Studies by various authors have indicated different theories that can explain the role of expenditure by the government in the provision of service delivery and public goods provision. The model is key in social welfare maximization of as well as the economic growth contribution to the overall rate (Foley, 2003; Dutt, 2011; Tandi, 2013; Viscusi & Gayer, 2015; Zoran, 2015; Soydan & Bedir, 2015).

The theories discussing expenditure by government e were identified through Wagner's law suggested that the growth in economies should positively

growth with growth in government expenditures on public goods. Wagner's discussion further argued that increase in government expenditure on public goods results in creation of progressive economies. The growth is attributed to direct linage in economic growth, however, government expenditure on public goods is expected to have a greater impact on national outputs as compared to national inputs. By adopting the Wagner's law "augmented" version used in various studies while adopting differentiated variables, the results somewhat showed similar outcomes. The variables used in the model included proxies government expenditure such as Expenditure on Capital products (CEX), Gross Domestic Product contribution in the economy (GDP) proxied as growth in the economy, as well as national population which was represented as (POP) as well as proxies for budget deficit (BDF).Analysis of the models evolved within the different studies and resulted in:

$$Log(CEX_t) = a_1 + b_2 \log(GDP_t) + \mu_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2.1$$

$$Log\ (\frac{CEX_t}{pop_t} = a_1 + b_2 \log(\frac{GDP_t}{pop_t}) + \mu_{2t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2.2$$

$$Log\ (\frac{CEX_t}{GDP_t}) = a_3 + b_3 \log(\frac{GDP_t}{pop_t}) + \mu_{3t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2.3$$

$$Log\ (\frac{CEX_t}{GDP_t}) = a_4 + b_4 \log(\frac{GDP_t}{pop_t}) + \mu_{4t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 24$$

$$Log\ (\frac{CEX_t}{GDP_t}) = a_5 + b_5 \log(\frac{GDP_t}{pop_t}) + \mu_{5t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2.5$$

The equations presented in 2.1, 2.2, 2.3, 2.4 and 2.5 were discussed and improved by Hanushek and Woesmann (2013) who reviewed studies undertaken by Peacock and Wisemann in 1979; Gupta in 1976; Goffmann in 1968; Musgrave in 1969 and Murthy in1994. The equations presented in 2.1 explained notable results that showed ratios of budget deficit were expected to increase among developing countries given that revenues generated by the government would be low compared to overall expenditures for service delivery sectors including education. The challenge experience while analyzing the models had close relationship with economic growth and were critical to alleviating poverty when and if less developed counties adopted economic liberation and financial policies. It was, however, noted that the explanatory variables which were related to government spending and development resulted in higher levels of budget deficits and urbanization among other benefits.

To supplement the works outlined by the Wagner's Law, the reviewed studies on government expenditure included studies undertaken by Musila and Belassi, (2004); Woessmann (2007); Mallick and Dash, (2015); Viscusi and Gayer (2015) Zoran (2015) and Mallick et al., (2016). These studies revenues from taxation and utilization within government expenditure had endogenous growth. The growth had an effect that was direct on production functions on private investments. In reference to studies that referenced Peacock and Wiseman theory developed in 1967, it was noted that government expenditure's role in productivity integrated into political and economic disturbances within government expenditures and available revenues. This

argument was supported by both the Keynesian approach to public expenditure as well as the classical economist's view.

In addition to these theories reviewed, various models such as the Pigou's Condition developed in 1932; Musgrave Condition and Bowens Model developed in 1943 and Solow Model that was developed in 1956 were linked to the models that as well discussed the role of expenditures by the government expenditure in enhancing economic growth (Afonso & Jalles, 2013; Flavin, Pacek & Radcliff, 2014; d'Addio, 2015; Michel, 2017).

In more literature reviews, the government and public expenditure theory showed a direct and positive relationship between the theory of public choices theory and political and educational scene which were noted to be a potent, contemporary and coherent factor for developing economies. The application of these theories was based on the organization and content for different programmes of education. Further, theories applied to determine rational choice while making decision on non-market products and services were discussed within the framework.

While referring to the studies undertaken by Viscusi and Gayer, (2015) and Sunde, (2017), government expenditure theories had frameworks that were catallactic as governments made decisions to adopt utilities achieved by the citizen through the action of collective bargain on processes within the existing political environment. These theories further assumed that unit firms involved in a political processes pursued maximization principle the utilitarian principle of maximization which was subject to budgetary constraints and

markets outcomes that would affected the expected optimization (Joshi, 2006; Yildirim et al., 2011; Jiang et al., 2011; Tandi, 2013; Owusu-Owusu-Nantwi, 2015; Viscusi & Gayer, 2015; Sunde, 2017). To manage the stable education sectors and survival of economies in developing countries, governments outlined sets of instruments needed to that produce particular services and goods in order to operate in the existing market. These markets would apply equal measurement of evaluation as previously applied in traditional price theory (Tullock, 2006).

The model further concluded that concerns identified by government expenditure theories were least applied in government while providing services to its citizens resulting in "political failure" or "government failure", which is a clear indication of possible market failure. The failure by the government to operate markets was explained by scenarios environments that were comparative to less deserving markets that would operate better than alternative social arrangements (Holcombe, 2001; Sunde, 2017). As outlined in the education sub-sector, if models of behaviors for individuals seeking public choices would be comparable to behaviors adopted by economists and modelers working on choices to be adopted by individuals. The expected outcome would estimate government and individual decisions which in most cases would fail as outlined in the market failure principle when governments operate markets.

Notable failures of markets within government operations are proven by recurring loss of individual choices of citizens based on purchase power parity

and related economic potential. These results are based on a lack of poor "public interest" which are beyond and over the individual citizen interests. The conclusion is derived by the political class which works on observed processes regardless of decisions that are in existence within institutions and related regulations. This environment led to imposition of coerced and undesired results that were applicable to a few citizens within a social group.

While refereeing to Musgrave (2008), choices of a public good within a policy approach, led to minimal contribution to the recovery of existent knowledge discussed. The conclusion of the theory asserts that Theory of public choices has negatively contributed to choices made by the citizens that have resulted to reduction in liberal substitution (; Zoran, 2015; Soydan & Bedir, 2015; Viscusi & Gayer, 2015). While linking to efficiencies expected, control of survival frameworks that constitute positive alternatives that form critical elements of the theory of government expenditures. Therefore the alternatives available under the government expenditure theory that needed to be key attention included rent-seeking and bureaucracies' behaviors.

2.2.2 Theory of Human Capital

The theory of human capital began with the classical authors' work that included Smith and Marshal in the 1890s. In their work, the classical economists argued that an educated person at the expense of much time and labor compared to one or more machines in an environment of production. Further, Smith and Marshal further noted that an educated man may perform equivalent to the levels of education and experience acquired. The reviewed

literature established that Smith and Marshal referred to industrial training as a national investment. Thus, current studies borrowed from the classical economists and found that education was viewed as an investment that involved time and costs and which were used to evaluate the levels of the quality of acquired human capital (Earle, 2010; Solaki, 2013; Benos & Zotou, 2014).

In this regard, from the work of classical economists, models of human capital analysis by the neoclassical economists were used in labor markets to define the levels of contribution made by the quality of education to economic growth. These models were supported by expenditure by the government as a proportion of GDP, further, the models presented estimated social returns to education which will help explain the contribution of levels of education acquired to growth in the economy. Further, the proponents of the theory of human capital asserted that expenditures on education should have been enhanced to ensure that the rate of return to additional spending on education is equivalent to the aggregated grate of return on invested capital. The level of evaluation achieved is thus necessary to the theory of human capital as it is viewed as the primary delivery means for skills and knowledge development. The acquired skills are important when economists qualify labor quantity within productive environment (Ferrer & Ruddell, 2002; Solaki, 2013; Benos & Zotou, 2014; Zoran, 2015; Soydan & Bedir, 2015)

The works undertaken by classical economists were supported by a study undertaken by Eggoh et al., (2015) who found that the measure of human capital was derived from functions that were to be achieved by schools which

were narrowed to provision of information, development of skills and teaching of pupils. The skill development process is critical to evaluate the value of life at present and in future. The achievement of the functions outlined within the programme for education system, government investment in education should incorporate the current levels of income, generated by capital possession which have future non-monetary and monetary returns on investments. (Idrees & Siddiqi, 2013). According to neoclassical economists, a basis that would later become the science of human capital was formulated (Nolan, 2013; Kotosz & Peak, 2013).

An argument on the deficiencies in the theory of human capital which was highly studies by the neoclassical economics as evidenced by Benos and Zotou (2014) and Soydan and Bedir (2015) noted that the theory of human capital was based on the fact that human-behavior is built and anchored on individual economic self-interest which operates freely in competing markets. The competitive market found that an environment of human treatment and related individual interest were among factors that distorted the market model. The competitiveness which developed market distortion and led to the analysis was that education acquisition contributed positively to variations in incomes between laborers and only within circumstances that were verifiable (Keller, 2006; Viscusi & Gayer, 2015; Zoran, 2015; Mallick et al., 2016).

The model on human capital was therefore expressed by Joshi (2006); Zivengwa (2012); Hanushek (2013) and Raheem et al., (2018) and it provided the relationship between incomes generated using physical capital which was presented as:

$$y(i,t) = h(i,t)w(i,t) + a(i,t)r(i,t), (1) \quad \text{.....2.6}$$

where

$h(i,t)$ is the human capital level for i pupil in time t

$w(i,t)$ and $r(i,t)$ is the return in the assets and rate of wages that are provided respectively.

In addition to the determination of incomes achieved through studies undertaken by Joshi (2006); Bowers and Urick (2011); Yildirim et al., (2011); Jiang et al., (2011); Zivengwa (2012); Tandi, (2013); Owusu-Owusu-Nantwi (2015); Viscusi and Gayer (2015) and Sunde (2017) provided evidence on the achievement that formation of human capital provides in the of income distribution processes within the underlying imperfections of financial market.

Further, government expenditures on education acquisition had led to human capital growth across generations. This process of education acquisition is expressed as:

$$h(i,t) = h\left[e(i,t), s(i,t)\right] \quad \text{.....2.7}$$

where

$e(i,t)$ is the accumulated level of education quality

$s(i,t)$ is the schooling expenditures incurred by a household to a student while striving to accumulate human capital.

The environment within which schooling takes place in order for students to acquire requisite human capital levels provides a complementary relationship that is between education expenditures and related quality which is explained as: $\frac{\partial^2 h}{\partial e \partial s} > 0$. The equation 2.7 explained that the capacity and levels of human capital acquired which were specified as:

$$e(i,t) = \rho e(i,t-1) + \varepsilon(i,t) \quad \text{.....2.8}$$

where

$0 \leq \rho < 1$ and $\varepsilon(i,t)$ are the education quality random components of acquired during schooling.

Notably, education provision levels were determined through notable indicators related to school location, quality of teachers and the related variables existing in a school environment.

2.2.3 Theory of Production

Production function in a school setting provided a means of understanding the overall process of input to output production process. This was achieved by undertaking an estimation of the effect of existing inputs that were provided to generate an expected level of output expressed as a performance indicator for a school t. The input-output process of analyzing the performance of school measures of performance. This analysis was built upon reviewed literature on production function within a school. The literature reviewed supported the production theory by incorporating different levels of factor inputs such as capital and labor force which would be applicable in achieving outputs

expected within the production models, such as school examination results. (Carnoy et al., 2001; Raposo & Menezes, 2011; Kanina, 2013; De Witte& López-Torres, 2015; Cordero-Ferrera et al.,2015; Shiozawa, 2016; Baqaee & Farhi, 2017b; Johnes et al., 2017).

Some outputs within a school setting were provided as correlations for inputs incorporated in the model that was analyzed through a regression analysis framework. The framework of analysis through regression sought to determine whether increasing allocated inputs in the education programmes provided equal or different measures of outcomes expected especially in levels of enrolment and education quality. The analysis of the production theory applied variables related to school operations such as class and teacher numbers, levels of government expenditure, as well as quantity of instructional materials. These variables defined inputs to education provision within a school. Therefore, the production model for a school had some variables differentiated from zero. These variables included the number of pupils in a class and the amount paid to teachers as wages which had limited or no contribution to the performance of a school.

The production theory thus assumed effectiveness within a school setting defined the levels of achievement that were expressed by examination scores in reading and arithmetic. The levels of knowledge and skills acquired were critical in defining the performance of schools. (Glewwe & Kremer, 2006). The production theory was further criticized through different studies because of its inability to account for artistic, behavioral and social, and outcomes that

were resulted by a schooling process towards human development (Carnoy et al., 2001; Baqaee & Farhi, 2018).

In other studies that were reviewed, the production function considered an output-oriented perspective that included economies of scale, input demand elasticities, and factor substitution. Some of the major considerations in a production function were either within the Cobb-Douglas form or translog model. The functional choice model that was used in the reviewed studies had provided for implications that resulted into isoquants shapes and differentiated factor demand elasticities as well as in subsidies factor prices. When the multiple output cost functions are expressed in a Cobb-Douglas function within a production function, the notable output-space implications o presented as output possibility function exhibit convexity characteristics (Greene, 2010; Zivengwa, 2012; De Witte& López-Torres, 2015; Cordero-Ferrera et al., 2015). The convexity application in a model applying translog function in the production function for determining outputs in a school output, given k inputs is expressed as:

$$\ln y = \alpha + \sum_{k=1}^{k} \beta_k \ln x_k + \frac{1}{2} \sum_{k=1}^{k} \sum_{m=1}^{k} \gamma_{km} \ln x_m \quad \text{.....2.9}$$

The equation expressed in 2.9 explains convex characteristics in a multiple output translog cost function for l outputs from k inputs (Shiozawa, 2016; Baqaee & Farhi, 2017b). Further, the analysis provided in the translog model equation is presented as:

$$\ln C = \alpha + \sum_{k=1}^{k} \beta_k \ln w_k + \frac{1}{2} \sum_{k=1}^{k} \sum_{m=1}^{k} \gamma_{km} \ln w_k \ln w_m + \sum_{s=1}^{L} \delta_s \ln y_s + \frac{1}{2} \sum_{s=1}^{L} \sum_{t=1}^{L} \phi_{st} \ln y_s \ln y_t + \sum_{k=1}^{K} \sum_{s=1}^{L} \theta_{ks} \ln w_s \ln y_{st} \quad \text{.....2.10}$$

The equation 2.10, explains that the model relaxed various restrictions on substitutes' elasticities and elasticities of demand. The model was further adoptable by the use of multiple outputs within the translog function, however, side effects that were no existent of globally convex or monotonic characteristics as provided for in the Cobb-Douglas function (Worthington, 2001; Kwabena & Appiah, 2004). The condition for monotonic function within the model explained as:

$$s_k = \frac{\partial \ln c}{\partial \ln w_k} = \beta_k + \sum_m \gamma_{km} \ln w_m \geq 0, k = 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2.11$$

Where k=1 are the factor shares which were non-negative

Therefore conditions for concavity in the model development was also expressed as:

$$\Gamma = [\gamma km], S = diag\ [s_k] \text{ and } s = [s_1, s_{2,\ldots,} s_k]^T \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2.12$$

In expressing school technical efficiency which is integrated into the input and output model, the function of production model was expressed as the framework of transforming a set of inputs explained as $x \in \Delta_k^+$ into outputs sets $y \in \Omega_M^+$. Thus transformation process of a production function was expressed as $T(y, x) = 0$ where 0 had the natural view normalization. Therefore, the process an analyzing the production function was explained using input requirement set:

$$L(y) = \{x : (y, x) isproducab \quad le\} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2.13$$

where

L(y) is the vector of output y. In this case, any member of the input requirement set was sufficient to produce the output vector.

The analysis thus explained efficiency as a presentation in the production model defined by the isoquant:

$$I(y) = \{x : x \in L(y) and\ \lambda x \notin L(y) if\ 0 \leq \lambda < 1\} \quad \text{.....2.14}$$

The isoquant explained in equation 2.14, explained defined the border within the input requirement set captured as:

$$ES(y) = \{x : x \in L(y)\} and\ \{x' \notin L(y)\}\ for\ \{x'\} when\ \{x_k' \leq x_k \forall k\} and\ \{x_k' < x_j\ for some j\} \quad \text{.....2.15}$$

The equation explained in 2.11 was further presented in **Figure 2.1**:

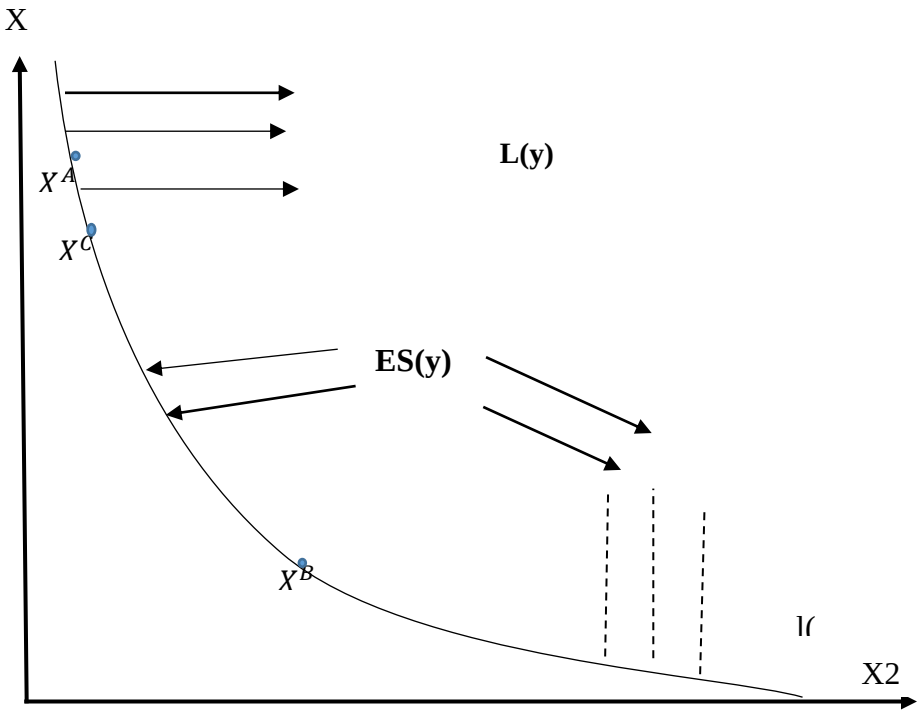

Figure 2.1: Input requirement set in Technical Efficiency process

Figure 2.1indicated that $X^A = (x_1^A, x_2^A)$ was on the isoquant, but it was not an efficient subset. This was because there was a slack in x_2^A. X^B which was both $I(y)$ and $ES(y)$. The distinction between these two sets was applicable in the Data Envelopment Analysis (DEA) model.

Studies by Sotiriadis, (2016) and Johnes et al., (2017) explained that the input distance function expressed as $D_I(y,x) = \max \left\{ \lambda : \left[\frac{1}{\lambda} \right] X \in L(y) \right\}$

and

$D_I(y,x) \geq 1$ 2.16

where

$D_I(y,x) = 1$.

Further analysis by the initial work on efficiency undertaken by Debreu and Farrell in the 1950s and reference by Worthington (2001); Santín and Sicilia (2014), and Cordero-Ferrera et al., (2015) found that input-oriented technical efficiency was given as:

$TE(y,x) = \min \{\theta : \theta x \in L(y)\}$ 2.17

The equation 2.13 was solved as:

$TE(y,x) \leq 1$ 2.18

and therefore, technical efficiency was defined as:

$TE(y,x) = \frac{1}{D_I(y,x)}$. 2.19

According to Santín and Sicilia (2014); Cordero-Ferrera et al., (2015); De Witte and Lopez-Torres (2015); OECD (2015) and Sotiriadis (2016), the measure of efficiency may not be equated to 1 if some levels of inefficiency were exhibited and $TE\,(y, x) \neq 1$. In this case, TE would be θ, and $0 \leq \theta \leq 1$, thus the level of inefficiency was $1 - \theta$ as presented in **Figure 2.2**.

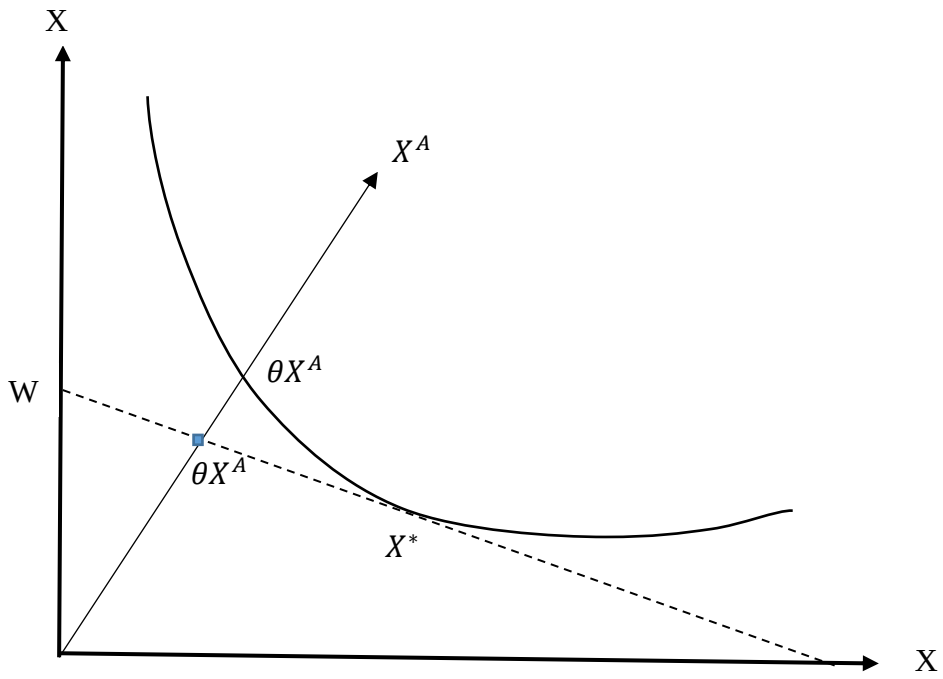

Figure 2.2: Technical and Allocative Inefficiency

The Debreu –Farrell production model outlined in Figure 2.2 was expressed as:

$y_i = f(x_i, \beta) TE_i$ ……..……..2.20

Where

$0 < TE\,(y_i, x_i) \leq 1$.

In the equation, β is the vector of a parameter estimated in the production function. The production model discussed was linear in logs for the variables and was expressed as:

$$\ln y = \ln f(x_i, \beta) + \ln TE_i = \ln f(x_i, \beta) - \mu_i \quad \text{.....2.21}$$

where

$\mu_i \geq 0$ is a measure of technical inefficiency.

The assumption outlined in equation 2.16 and 2.17 holds given that:

$$\mu_i = -\ln TE \approx 1 - TE_i, \text{ thus } TE_i = \exp(-\mu_i) \quad \text{.....2.22}$$

In a learning environment within school the production theory adopted used various measurements of technical efficiency measurements which included the modern measurement of efficiency This measurement began with Cordero-Ferrera et al., (2015); Shiozawa (2016) and Baqaee and Farhi (2017b) found that the models characterized a straightforward firms' proficiency which had various sources of info and more than unit yield. One of the yields in the grade school setting would be the school enrolment and school test scores. While investigating the specialized productivity model, the proficiency estimation would incorporate both allocative and specialized effectiveness (De Witte & Lopez-Torres, 2015; Sotiriadis, 2016).

Typically, specialized effectiveness estimation in information compelled primary schools would cover different periods so as to clarify all-out efficiency changes. Given a circumstance where a school had compelled

inputs. The attention would be on the information accomplished from an information point of view known as the information arranged specialized proficiency. Further, the upside of applying input-output specialized effectiveness was that the sum by which input amounts were proportionately extended didn't change the number of yield amounts created

Therefore, studies by Santín and Sicilia (2014); Cordero-Ferrera et al., (2015); Shiozawa (2016) which borrowed from the earlier researchers including Farell and Koopmans in the 1950's discovered that efficiency in a school setting was given as the proportion of yields from inputs provided to output expected given the level of quantity of input-output data sources used as presented in Figure 2.3.

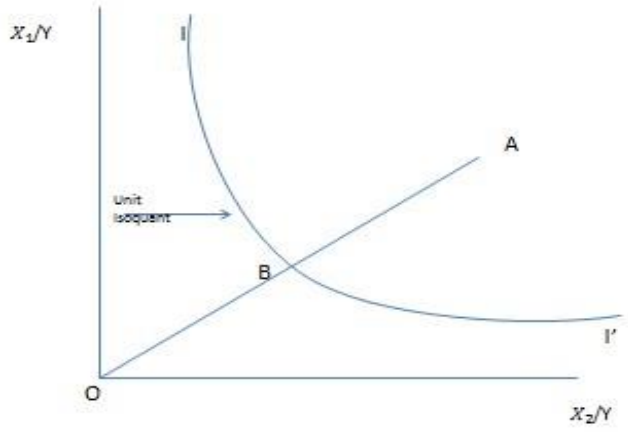

Figure 2.3: Technical Efficiency and the production frontier

The **Figure 2.3** presented Farrell's theory of the production frontier which involved original input and output values. The horizontal axis denoted the amounts of inputs, X, that were utilized to produce output, Y. When input-output values were utilized, on the production frontier (π), then the given schools did not attain the maximum possible output. As indicated in Point A, the technical efficiency of a given school producing output, y from inputs x could be calculated as $\frac{y}{y''}$ where y'' was the quality of output B on the production frontier. Figure 2.3 further indicated that schools with yield esteem below the production frontier were said to be actually wasteful (inefficient). The reasons for the levels of inefficiency would, in this manner, be characterized and accordingly it was imperative to set up their causes.

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The components utilized in the estimation of the information situated within the input-output productivity approach were assembled into parametric and nonparametric methodologies. The parametric way to deal with effectiveness assurance accommodated the practical type of the generation work and made suspicions about mistake terms that were not seen in non-parametric outskirts. Then again, non-parametric methodologies utilized direct programming methodologies and every now and again applied Data Envelopment Analysis (DEA) for investigation.

A few correlations made among parametric and non-parametric boondocks that were recognized included (i) Parametric wildernesses expect that every one of the deviations from the frontier were due to schools' inefficiency; while non-parametric boondocks disintegrated the deviations in to two sections because of measurable commotion and explicit inefficiency levels the frontier (Santín & Sicilia, 2014; Cordero-Ferrera, et al., 2015; Shiozawa,2016; Baqaee & Farhi, 2017b; Baqaee & Farhi, 2018); (ii) The parametric frontiers were sensitive to mis-specifications, discarded factors and estimation mistakes dissimilar to non-parametric (Jacob, Smith & Street, 2006; Shiozawa, 2016); (iii) Both parametric and non-parametric outcomes didn't vary altogether with the utilization of DEA which were been profoundly utilized in beneficial proficiency investigation particularly in situations where multi-yield and scarcity of value information existed; (iv) When the useful structure was shut to the basic innovation, at that point stochastic boondocks examination (SFA) functioned admirably than DEA.

However, DEA was generally utilized because of its ability to address conditions found in the parametric and non-parametric examination. This DEA quality over parametric estimation was that parametric utilitarian structures ordinarily utilized incorporated the Cobb-Douglas functions, Constant Elasticity of Substitution (CES) and translog creation capacities (Thieme et al., 2012; De Witte & Lopez-Torres, 2015; Sotiriadis, 2016).

Given the prevalence within DEA, the impediments related to the other three strategies (Ratio Analysis, Stochastic Frontier Measurement, and Regression Analysis) were tended to. The DEA quality over different models included: (I) DEA changed over data sources and yields into a solitary proportion of effectiveness for each school, (ii) DEA dealt with numerous information sources and yields without prerequisite for homogeneous estimations, (iii) DEA could modify for exogenous factors that were outside control of firms the executives, (iv) DEA didn't require explicit useful structure relating contributions to yields, in order to process the proficiency of a school and (v) DEA concentrated on watched best practice outskirts not at all like stochastic frontier models which concentrated on focal propensity properties (Mizala & Rumaguera, 2000; Worthington, 2001 Kwabena & Appiah, 2004; Thieme et al., 2012; Nyamoita, 2013; Sotiriadis, 2016; Johnes et al., 2017).

The DEA quality in the model likewise gave an exhaustive examination of specialized productivity scores despite the fact that it didn't plot reasons for inefficiency. In this circumstance, the controlled relapse model was utilized to identify if proportions of inefficiencies were identified with factors that might be the source of inefficiencies. An edited Tobit model was applied to keep away from asymptotically one-sided gauges from standard least squares with the DEA results (Greene, 2010; Thieme et al., 2012).

2.3 Empirical Literature

This section analyzed existing writing that had been embraced on school enrolment, training quality and specialized effectiveness in open grade schools.

2.3.1 Enrolment in Public Primary Schools

Education had been seen as a cultural procedure contemplated by a few creators to set up enrolment levels and patterns in school participation in grade schools. The enrolment patterns were utilized to clarify the interest for instruction which was either financed by the two family units and governments working in a political, arrangement and legal conditions (Mizalla & Romaguera, 2000; Tinker, Iscan & Rosenblum, 2013; Gupta, 2017; Eregha, Irughe & Edafe, 2018).

In relation to Mizalla & Romaguera (2000), a study by Tinker, Iscan & Rosenblum (2013) on an appraisal of training interest throughout the previous 40 years in Africa was embraced including Kenya. The examination utilized a direct relapse model in its investigation and found that the presentation of school charges diminished school enrolment without accomplishing critical quality upgrades. The investigation additionally found a clear relationship between motivating force gave in a circumstance where school expenses and other direct instructive expenses were sponsored or gave. Accordingly, circuitous expenses related to schools had a huge and critical impact on school enrolment in a rundown, Mizalla, and Romaguera (2000) and Tinker et al., (2013) didn't give solid or precise connection between school use and understudy execution particularly on enrolment, a reality likewise distinguished by Gupta, (2017) and Eregha et al. (2018).

Further to the studies above, Mizalla & Romaguera (2000) did an examination of the impact of the voucher framework for both private and state-funded

schools in Chile. In the examination, Mizalla and Romaguera (2000) utilized individual, family and school qualities which comprised private expenses paid just as private sponsored voucher frameworks in elementary schools. The examination applied the OLS strategy for investigation just as the Two-Stage Least Squares (TSLS) model to control for school decisions. Discoveries from the investigation built up that normal test scores in essential instruction were related within the vector of family, school and individual attributes. The nature of instruction communicated by test scores was additionally identified with youngsters' wellbeing, financial level, school's possession index list, school geographical index, teacher experience, and pupil-teacher ratio. The restriction distinguished in the investigation in connection to school performance was that the outcomes indicated in the limitations execution had practically zero critical distinction among private and public school performance. This constraint was a piece of the key pointers explored in this investigation.

An additional study by Hanushek (2003) sought to build up the financial and economic matters related to teaching, production, development, and effectiveness in American schools. The examination discoveries clarified the impacts of expanded resource consumptions on various school qualities, for example, enrolment. Some portion of the investigation discoveries noticed that expanded uses didn't offer a motivator to instruction improvement particularly on enrolment. These discoveries repudiated the Kenyan government's inspiration that was applied while creating, advancing and actualizing the FPE. The examination by Hashunek (2003) inferred that evaluations on pupil-teacher proportion, teacher training, teacher experience, compensation and

government expenditure per pupil had no critical impact on school performance communicated as conclusive test scores. Also, the exhibition pointer communicated by scores whose assessments were modeled and had a high likelihood of inclination. The investigation further found that conditioned pupils were set up for the assessment, a circumstance that could include over perusing or assessment acts of neglect dissimilar to in an unconditioned assessment condition where the off the cuff test was controlled to build up the genuine pupil accomplishment, subsequently elevated levels of inclination.

The analysis from Hashunek's (2003) work negated past examinations in Kenya on FPE that indicated some huge connection between government expenditure, school performance, and different school inputs. Hanushek (2003) however, upheld undertaking of this examination, where the utilization of scores from an unconditioned evaluation utilizing SACMEQ class 6 scores would give impartial result (Gichura, 2003; Musalia, 2005; Klees, 2008; Mathooko, 2009; Bold et al., 2010; Reche et al., 2012).

While assessing the impact of accessible resources on student performance in a school; Hashunek and Woessmann, (2016), considered the impact of the school resources on pupil accomplishment. The author condensed 60-grade schools to decide the economic and financial attributes identified with school resources. Discoveries from the examination built up that interest for training clarified by enrolment was characterized by the social capital status of family units. In the examination, socio-capital status advanced the demand for school enrolment, private additions, and gains from education performance, choice of

school and assessment motivating forces that were given to improve school execution, particularly in public primary schools. The results were confirmed by Klees (2008); Bold et al. (2011) and Reche, Mbutu, Riungi, and Mbugua, (2012**)** who found that there exists no relationship with the outcomes and delineated that private schooling gains relied upon singular students' condition while learning.

Further, a study by Gupta (2017) investigated educational foundations of fast-growing and emerging economies of world economies identified as BRICS (i.e. Brazil, Russia, India, China, and South Africa) which compared educational achievements in literacy, enrolment, school years and education expenditure between them and with select advanced countries. In its results, the study found that a correlation existed between enrolment and school years with GDP and expenditure in education. Further, the findings found that BRICS still lagged behind in developed countries and that GDP and education expenditures were related positively to enrolment and school years.

In an additional study, Cooper (2017) found that the literature on the subject of school resources and student outcomes tends to find that there was a positive relationship between both variables. Cooper (2017) noted that literature used per-pupil spending (PPS) or teacher salaries as a measure of school resources; however, the study focused on capitation financing based on per-pupil spending. Using data from the Illinois State Board of Education from 2006 to 2016 and measuring student outcomes through average ACT scores, operational PPS was found to be insignificant, whereas instructional PPS was found to be positive and significant at the 5 percent level. The estimates

suggested that a 1 standard deviation increase in instructional PPS leads to a 0.043 standard deviation increase in ACT scores. Coefficients for teacher salary which was another indicator of school resources were found to be positive and statistically significant at the 5 percent level, where estimates indicated that a 1 percent standard deviation increase in this important variable is associated with a 0.05 standard deviation increase in ACT scores. Though both of these indicators were associated with fairly modest increases in ACT scores, the estimates were consistent with most findings in the relevant literature, i.e. there was a positive relationship between student outcomes and school resources. These results carried important information that policymakers should effectively allocate resources in their quest to increase school quality. The results argued that both access to instructional funding and monitoring school efficiency in utilizing funds were key to improvements in school quality

A study by Eregha, Irughe, and Edafe (2018) outlined that the education and economic growth in Nigeria and discussed the impact of applying various levels of education programmes in Nigeria's trends in the sector growth using fully modified OLS estimator. The results revealed that different levels of education impact were at varying magnitude on each of the components of growth which were positive in Nigeria. However, the magnitude of the impact on education was much higher from the school completion rate. The study further found that the implication of the school completion rate among students enrolled explained that the growth in student numbers provided higher impact that the requisite rates of enrolment. Thus, governments should endeavor to give modalities to abridge the school dropout rate in the schooling

framework as a measure to help finishing rates that would encourage development and facilitate economic growth.

2.3.2 Quality of Education in Primary School Education

This section investigated studies that were done to build up the relationship between government expenditure and the education quality in a school setting.

An investigation by Mizala and Romaguera (2000) utilized TSLS examination to show how motivators by the voucher framework were much the same as the public schools as opposed to tuition-based private schools in the Chilean education system framework. The investigation utilized the OLS model of analysis however it was restricted to determine the levels inclination and bias which happened as the examination didn't control for endogeneity in school type and area. The factors controlled for were not normal for the Two-Stage Least Squares (TSLS) concerning impediments identified with guardians' training achievements which didn't relate positively to the child's performance since it was encouraged by the voucher framework. Notwithstanding the way that government financing to family units relied upon school type, the test scores gained by pupils were progressively equivalent among children from families of all financial and socio-economic classes. These homogeneous qualities were found in children going to both public and private schools.

The result by Mizala and Romaguera (2000) upheld Klees (2008); Republic of Kenya (2005) and Clotfelter, Ladd, and Vigdor (2011) who set up that in a comparative domain and environment regardless of family foundation; all children ought to perform similarly. Further, the investigation distinguished that the effect of government expenditure on scores accomplished was not all

around featured in light of the fact that independent of school attributes, uniform motivations and incentives were given. The non-consistency recognized was a gap in the investigation that made the reason for discussing about the effect of government expenditures on school performance in this study. The gap additionally required the need to research capitation allocation among students and respective schools which was equivalent over all areas regardless of family unit earnings.

While examining the impacts of fluctuating investment on educational accomplishment among blacks, Hispanic and white males in Chicago schools, Cameron and Heckman (2001) analyzed their information utilizing the ordered decision model. The results from the agents relied upon inborn limit (given by IQ) and components describing the family unit foundation. The examination noticed that the Intelligence Quotient (IQ) test scores were utilized as a control variable for the capacity of knowledge acquired versus the level of investment in education. Further, the study found that the coefficients for the two control factors significantly affected the detainees' educational achievement. The educational investment ratios regarding school type and race were not figured in the model which was a verifiable gap. This impediment, along these lines, couldn't establish whether differentiated race and government investment in knowledge acquisition had any impact on the scores accomplished among the prisoners.

An investigation of the nature of training for primary schools in Peru by Abt Associates (2007) utilized linear regression models in the examination. The study found that while Peru had achieved universal enrolment rate in primary

education, education quality was relied upon school inputs, for example, teacher attributes and individual student financial and socio-economic qualities. Different attributes utilized in the investigation included peers at the school and related community just as an institutional set-up. In synopsis, the study didn't give a reasonable connection between family units' financial attributes just as children's educational performance. These outcomes were planned for accomplishing the unit level of speculation for schools and pupils that start from families or the government expenditure on education.

An investigation embraced in Kenya by Bold et al., (2013) on the impact of FPE on school enrolment utilized the OLS regression model for the analysis. The investigation discoveries built up that interest for education particularly in state-funded schools that expanded with the introduction of motivations programs. The study further distinguished that the quality of education in Kenyan schools depended on KCPE results which were poorly contrasted with expanding enrolment rates. The discoveries further clarified that education quality was additionally undermined by laxity among headteachers, supervisors and Parents Teachers Association (PTA) members. The comparison was brought about by the centralization of school expenditure under FPE. The outcomes additionally noticed that enrolment among private and government-funded schools was one-sided.

The inclination was exhibited by the subsidized education system and expanded interest for the private schooling framework. A key restriction recognized in the study was the incorporation of family unit pay and not government expenditure based on enrolment and education quality. The

coefficients for government expenditure incorporation in the education process were certain on the scores achieved by both private and public primary schools. A further impediment of the investigation was occasioned by the utilization of KCPE results which were biased. Moreover, the investigation looked at private and public primary schools which were a choice for the family to choose where to enroll their children henceforth would apply a probit model other than OLS while determining the decision of a school.

A study by Kumar and Choudhary (2019) investigated expenditures the government incurs in facilitating education and the quality of education that lead to high-value, high skilled economies and a well-educated workforce in India. In the study, Kumar and Choudhary (2019) noted that education developed the capability for learning among individuals. It also helps in adapting knowledge and interpreting information and to an individual or local community. To evaluate the effect of education expenditure on economic growth in India, the study employed the conventional linear regression method, using GDP as a proxy for economic growth. In addition, total government expenditure on education was also used as a proxy for knowledge on the economy. In the results, it was confirmed that there was a positive relationship between education expenditure and economic growth. Hence, it was of utmost importance for the government to continue with the spending on education in order to have decent growth in the future.

In addition to Kumar and Choudhary (2019), Bashir and Amir (2019) analyzed the relationship between government expenditure on education and GDP per

capita in Pakistan. The study identified that education was one of the most crucial factors of economic development, and there was an agreement among policymakers that countries in which quality education was accessible to all did better. The study was designed to investigate the long and short-run nexus among public expenditure on education and GDP per capita by utilizing annual time series data for the period 1971 to 2017 using the Auto-Regressive Distributive Lag (ARDL) approach. The results found that there existed short term co-integration among public expenditure on education and GDP per capita and this confirmed the long term positive significant influence of public expenditure on education on GDP per capita which in return affected the quality of education acquired.

Further, Islam and Khan (2019) investigated the effect of human capital development on the economic development of Bangladesh. The investigation utilized current expenditure on wellbeing and open/public cost on education to quantify the human capital development and development of total national output as an economic development intermediary. The examination applied time-series data for the period 1998 to 2017 and applied the Augmented Dickey-Fuller unit root test to decide levels of data stationarity. Johansen co-integration test was also applied to examine the long-run relationship among the variables while the Granger causality test was also was used to explore the direction of causality. The discoveries uncovered that expenditure in education caused economic growth decidedly, while current expenditure on health and wellbeing had no effect on economic development. Correspondingly, development in GDP made expenditure on health and wellbeing to rise,

however it had no effect on education expenditure. In addition, spending on education made health and wellbeing expenditures to increase as well. In this manner, policymakers were expected to concentrate more on education and furthermore discover methods for materializing the outcome of health expenditure.

2.3.3 Technical Efficiency in Public Primary Schools

A few examinations on effectiveness have been embraced in different disciplines including health care, education, and the manufacturing sector. The studies looked into in this sub-segment exhibited the estimations for technical efficiency identified with the education sector.

In surveying the productivity of Ghanaian optional training, Kwabena and Appiah (2004) characterized a few factors in the study. The factors utilized included pupil-teacher proportion, number of teachers prepared, student sexual orientation and cost of repairs undertaken as inputs and test scores in five subjects as outputs. While undertaking the investigation, the examination applied a stochastic frontier analysis that embraced under the censored regression model. The variables used included student-teacher ratio, the number of teachers trained, pupil gender and cost of repairs undertaken as inputs and test scores in five subjects as outputs. Discoveries from the examination uncovered that; levels of efficiency were inside the scope of 0.102 and 0.087. This implied the inputs utilized in different schools required better use so as to accomplish the necessary effectiveness and efficiency levels. In connection to this investigation, the main confinement distinguished in the examination was that; in spite of the need to improve input use, the investigation didn't build up the impact of performance on input change.

A model applying the two CRS and VRS input-situated was embraced utilizing stochastic wilderness examination and DEA model inside 2000 Chilean schools by Mizala and Miguel (2007) who utilized 9 contributions to the investigation. The inputs utilized in the analysis included financial and social-economic levels, weakness record, kind of school, geological file, school size, student-teacher proportion, regardless of whether pre-school training, sexual orientation and normal experience. The investigation utilized one yield - academic scores to evaluate the productivity level of the nation's education sector. The investigation results demonstrated that 93 percent of schools in Chile was, in fact, proficient at a scope of 73 percent and 98 percent from the stochastic outskirts examination under the dual variable DEA model. The investigation likewise recognized information sources that would change inefficiency in schools to the degree of productive and efficient schools. The dual variable DEA results set up that the technical efficiency level was 95 percent and lied between the scope of 53 percent and 100 percent.

To accomplish technical efficiency in these schools, the analysis results prescribed that more inputs were expected to deal with the reasons for expanding inefficient aspects. In spite of the fact that the study was far-reaching, social-economic and financial levels which would have affected interest in training were disaggregated by school type. The incorporation of investment variables in the investigation would clarify the connection among factors and school performance which was not given. Further, the investigation likewise utilized cross-section data for its analysis and along these lines, it couldn't set up performance levels in the different schools just as reasons for efficiency

In addition, Raposo and Menezes (2011) analyzed public school efficiency using DEA in Brazil. The study looked at the educational efficiency as determined only by the variables directly controlled for by the school and isolated from the influence of other environmental characteristics, such as student socioeconomic status that might have influenced efficiency as well. An alternative application of Simar and Wilson (2007) study on two-stage DEA model approach was adopted using data from public schools in the basic education level from the Northeast Region of Brazil. The results from the study showed that the rank of efficiency became much more homogeneous after isolation from the effect of environmental variables as compared to the rank produced from a simple one-stage DEA.

Within the Kenyan space, analysis of primary school's technical efficiency was u out by Nyamoita (2013). The study investigated the nexus between education inputs, outputs and labor market outcomes using the average and marginal benefit incidence of public education spending and the technical efficiency of public education spending at the county levels. The study sought to map and identify inequalities in education benefit incidence and efficiency using the 2005/06 Kenya Integrated Household Budget Survey data. The results from the study indicated that children from medium and high-income groups were more likely to benefit more from expansion in public education spending in Kenya. The results from the study also found that large differences in levels of benefit incidence across counties. The main factors that constrained households from benefiting in public education spending included

poverty, residing in urban areas, being a female child and low schooling level of the household head.

The efficiency results indicated that the average DEA double bootstrap technical efficiency scores were 1.24, 1.12 and 3.04, for primary, secondary and tertiary education levels, respectively. This implied that education outputs could be increased by 24 percent, 12 percent, and 204 percent at the respective education levels, without increasing inputs. Further, the study noted that education externalities in schools were higher in private rates of return to education. Further, the study noted that the country required policies to address pre-labor market inequalities in access and benefit incidence of education across counties, gender, and income groups as well as mechanisms to improve the technical efficiency of public education expenditures.

A further study by Kanina (2013) assessed technical efficiency and changes in all total factor productivity among public primary schools in Kenya assembled into 72 regions. The investigation applied the DEA-based Malmquist productivity index as the approach for analysis. In addition to the DEA model, the second-stage Tobit regression model was also used in the estimation to determine possible causes of inefficiency. The output utilized in the investigation included the mean scores accomplished in the Kenya Certificate of Primary Education (KCPE) assessment. Further, net enrolment levels, student class, and pupil-teacher proportions were utilized as inputs. In the second stage Tobit regression model, a spurious variable for the school area demonstrated by the location was included in the model.

The Tobit regression analysis set up that the coefficients for student-teacher proportion were negative on efficiency and furthermore at a 5 percent statistical significance level. This huge relationship affected the high pupil-teacher ratio that was related to the levels of inefficiency. What's more, schools situated in regions that were within urban areas were found to perform superior to their rural partners. Albeit an investigation by Klee's (2008) laid out the one-sided restriction of utilizing KCPE results as an unmistakable proportion of output in school. The investigation by Kanina (2013) did exclude expenditures as a key input to school technical efficiency determination. This was a gap recognized, thus, the investigation just examined technical efficiency, and however, the determinants of efficiency were not set up.

Further, De Witte and López-Torres (2015) carried out a study analysis on a model used on efficiency in education. The study summarised applied inputs, outputs, and contextual variables. The study also used cross-sectional data sources undertaken while determining efficiency in education. Moreover, the study reviewed various papers on education that applied methodologies as Data Envelopment Analysis (DEA), Malmquist index, bootstrapping, robust frontiers, meta-frontier, or Stochastic Frontier Analysis (SFA). Based on the insights of the literature review, the paper established a link between the parametric ‘economics of education’ literature and the (semiparametric) ‘efficiency in education literature’. The outcome from the study pointed the similarities between matching and conditional efficiency; difference-in-

differences and meta-frontiers; and quantile regressions and partial frontiers which were critical in determining the levels of efficiency in a school.

Cordero, Santin, and Simancas (2015) carried out an assessment of European primary school performance through a conditional non-parametric model that involved 16 countries participating in PIRLS 2011. This study represented an original enterprise since most of the empirical research in the field was restricted to evaluations at the regional or national level and focused on secondary education. The study adopted a meta-frontier framework to compare and decompose the technical efficiency of primary schools operating in heterogeneous contexts. This analysis was applied in cases represented by different educational systems or countries. Similarly, the study used an extension of the conditional nonparametric robust approach to test the potential influence of a mixed set of environmental school factors and variables representing the cultural values of each country. The results indicated that the intergenerational transmission of non-cognitive skills such as responsibility or perseverance was significantly related to school efficiency, whereas most school factors did not seem to have a statistically significant influence on school performance.

The foundation on the effect of government expenditure on education from a technology perspective was analyzed by Baqaee and Farhi (2017) who provided a general non-parametric formula for aggregating microeconomic shocks in general equilibrium economies with distortions such as taxes, mark-ups, frictions to resource reallocation and nominal rigidities. Given

expenditures in the education sector, Baqaee and Farhi (2017) assumed that macroeconomic impact of a shock disagreed into two components: its "pure" technology effect and its effect on allocative efficiency arising from the associated reallocation of resources, which could be measured via changes in factor income shares. These two components were determined by structural microeconomic parameters such as elasticities of substitution, returns to scale, factor mobility, and network linkages. Overall, the study agreed with Solow and Hulten in the 1950s and 1970s respectively who noted that economies operate with distortions which were demonstrated by the empirical relevance, based on mark-up distortions and non-parametric results. The results showed that improvements in allocative efficiency accounted for about 50 percent of measured TFP growth over the period 1997 to 2015. While implementing the structural results the conclusion held that eliminating mark-ups would raise TFP by about 40 percent, thus increasing the economy-wide cost of monopoly distortions by two orders of magnitude compared to the 0.1 percent estimates.

Johnes, Portela and Thanassoulis (2017) noted that education was very important at national, local and individual levels given its benefits that accrue to both to society and to individuals. The study highlighted that the provision of education in many countries was paid for at least in part from the public purse. With competing demands for government funding, it was important for education to be provided as efficiently as possible. Efficiency, therefore, occurred when outputs from education (such as test results or value-added) were produced at the lowest level of resource (be that financial or, for example, the innate ability of students). The study found that efficiency in

education provided a solution for governments that struggle with public finances in the wake of the global financial crisis

2.4 Summary of Literature

The evaluated literature indicated that enrolment in Kenya has been encouraged by government policies and financed by both households and the government through national budgetary allocations. The investigations looked into additionally sketched out that family unit expenditure and government motivating forces had a positive contribution to education and by augmentation impacted school enrolment. In any case, there was no investigation that incorporated expenditures on education from a family and government sources within two diverse time periods.

The reviewed literature likewise demonstrated a huge connection between government expenditure, family unit attributes, and school attributes to the quality of education. In any case, school location could in one way influence the quality of education. This perception was not decisively examined and would be discussed in the outcomes area of this study. Further, the reviewed literature noticed that there existed a gap within the differentiated learning conditions that came about to various scores in connection to government expenditure before and after FPE implementation (Mizala and Romaguera, 2000; Cameron and Heckman, 2001; Abt Associates, 2007; Zivengwa, 2012; Bold et al., 2013; Benos and Zotou, 2014; Eggoh, et al., 2015; Shiozawa 2016; Baqaee and Farhi, 2017b).

These gaps formed a justification to carry out this study and address the genuine impact of government expenditure on school performance. Eminently, the literature reviewed demonstrated that the analysis used the OLS regression model for cross-sectional data in most of the time. Different investigations in the study applied TSLS when decisions on schooling were broke down, however, no study utilized integrative models of analysis which will be applied in this study. This study used cross-sectional data over the three-year time frame and applied the pseudo panel cross-sectional model of regression that was utilized in the investigation to decide the effect of government expenditure on both enrolment and education quality.

Further, despite the fact that reviews explored technical efficiency utilized either DEA or Stochastic Frontier Analysis for efficiency estimation; none of the examinations assessed secured school technical efficiency with government expenditure as a key input. Likewise, study took into consideration different contributions to efficiency among them student-teacher proportion, pupil gender, school expenditures, family unit attributes and somewhat school qualities and, school yields that contained subject scores achieved during the assessment with the exception of Nyamoita (2013) who utilized school completion levels (De Witte& López-Torres, 2015; Baqaee and Farhi 2017; Johnes et al., 2017; Kanina, 2013; Raposo and Menezes, 2011). A restriction in the reviewed literature was that the last year test scores that were utilized in the investigation were biased in light of the fact that the assessment was done when students were adapted to take an assessment which in many

occurrences gave the biased scores (Baqaee and Farhi, 2017; Raposo and Menezes, 2011).

Outstandingly, the SFA model was regularly not utilized in the studies as it functioned admirably with a couple of inputs and outputs in examining technical efficiency levels. To explain this constraint, the DEA model was applicable in the vast majority of the studies because of its ability to change over inputs and outputs into a solitary proportion of efficiency. The proportion of technical efficiency would in this way be for every basic leadership unit containing different inputs and outputs without prerequisite for homogeneous estimations (Kwabena and Appiah, 2004; Mizalla and Miguel, 2007; Raposo and Menezes, 2011; Kanina, 2013; Nyamoita, 2013; De Witte and Lopez-Torres, 2015; Cordero-Ferrera et al., (2015). In every one of the analysis inspected, just one investigation by Kanina (2013) utilized TSLS to build up determinants of efficiency. Gaining from audited writing, this investigation embraced the DEA model for the examination of technical efficiency and productivity estimation. The outcomes were given exhaustive while tending to technical efficiency change, technological change, and scale efficiency. At long last, to build up the determinants of efficiency, this study utilized the censored Tobit model for TSLS analysis.

CHAPTER THREE
METHODOLOGY

3.1 Introduction

This chapter outlined the study research design, theoretical framework and various empirical methodologies applied, population area, method of data sampling, methods of data collection, the nature of the data collected and use. The information applied is used to determine how well the set objectives were achieved. The overall chapter also explained the type of data used, the sources of the data used and the methodology used in analyzing the data.

3.2 Research Design

The investigation utilized a longitudinal plan where time-series data for the periods 2000, 2004 and 2012 were utilized. The idea of the issue considered required that it was structured reflectively to take into consideration the collection of data to be embraced at periods previously, during and after the execution of Free Primary Education (FPE). The period before FPE execution received a cost-sharing expenditure system for primary schools, while the period after FPE expenditure accepted the program had balanced out. The methodology utilized in the investigation helped in surveying sway credited by government expenditure on school execution between the pre-within and post-FPE strategy presentation and usage period. The information utilized in the investigation was gathered from each of the 47 counties yet introduced in eight regions; while schools in different schools were utilized as the unit of analysis.

3.3 Theoretical Framework on Enrolment and Government Expenditure

This area was intended to answer the principal goal of the study. The goal was clarified under the hypothesis of government expenditure which talked about

the structure on how enrolment was affected by changes in government expenditure just as the latent family unit commitment is given dependent on different school attributes.

Eminently, Mankiw's (2014) study on the composition of the hypothesis of expenditure condensed the various exchanges on public expenditure speculations as laid out by Samuelson and Strotz during the 1950s and sketched out two products that are devoured by family units (yi) which are either pubic goods or private good. The consumed goods in a private entity schools were expressed as $(x_1,..., x_n)$ and could be consumed by various individuals $(1,2,..., s)$ according to the relation that;

$$y_j^i = \sum x_j^i \quad \text{.....(3.1)}$$

Where y is the output acquired from the consumption of the goods i and j

The accumulated utilization of products devoured by society in areas like training was communicated as:

:

$$x_{n+1},..., x_{n+m} \quad \text{.....(3.2)}$$

The synopsis by Mankiw (2014) called attention to that there exist conventional ramifications of leveling in (3.1) and (3.2). Adopting (3.2) in the education sector, the creation levels accomplished were given as:

:

$$u_i = f(u^2, u^3, ..., u^n) \quad \text{(3.3)}$$

Where u is the degree of utility accomplished by the school

Equation 3.3 was exhibited in a frontier where each point at the frontier d determined a set of all public goods such that:

$$x_{n+j} = g^j(u^2, u^3, ..., u^n); \; j = 1,2,...,m \text{ and } x_{n+1}, ..., x_{n+m} \quad \text{(3.4)}$$

As outlined in equation 3.4, purchasers augmented their utility consumers maximized their utility with every individual's utilization of the great, in this manner for every aggregate utilization, the sum expended was exhibited as:

$$x_{n+j} = x^i_{n+j} \quad \text{(3.5)}$$

The aggregate consumed good was likewise spoken to by a smooth and convex index sketched out as:

$$u^j = u^i(x^i_1, ..., x^i_{n+m}) \text{ and } u^i_j > 0 \quad \text{(3.6)}$$

The equation 3.5 and 3.6 demonstrated that the ideal yield expected on the production possibility schedules identify with the aggregate of all outputs, to such an extent that an aggregate utilization of goods

x is represented as $F(x_1, ..., x_{n+m}) = 0; F_j > 0$ with the $Ratio = \frac{F_j}{F_n}$

……(3.7)

Where

Fj is the output for the utilization of good X

F_n is the quantity of good X consumed

Equation 3.7 decided the generalized law of diminishing returns where the utilitarian function for schools profiting by different utilization levels of given inputs that were supported by the governments and family units. Getting from condition 3.6 and connecting to condition 3.7, the degrees of utility when a school consumes a specific good was composed as:

$$u = u(u^1,..., u^i) \text{ and } u_j > 0 \quad \text{.....(3.8)}$$

Thus, the outputs and satisfaction indexes explained in equation 3.6, 3.7 and 3.8 were expressed in a marginal rate of substitution condition such that:

$$\frac{u_j^i}{u_r^i} = \frac{F_j}{F_r}; \quad \begin{matrix} i = 1,2,..., s \\ r, j = 1,..., n \end{matrix} \quad \text{.....(3.9-a)}$$

$$= \sum_{i=1}^{s} \frac{u_{n=j}^i}{u_r^i} = \frac{F_{n+1}}{F_r}; \; j = 1,..., m; r = 1,..., n \quad \text{.....(3.9-b)}$$

$$\text{Then } \frac{u_i u_k^i}{u_q u_k^q} = 1 \quad \begin{matrix} i, q = 1,..., s \\ k = 1,..., n \\ q = 1; i = 2,..., s \end{matrix} \quad \text{.....(3.9-c)}$$

In this manner, the fulfillment of any consumed great to accomplish condition (3.9-c), will guarantee that specific expenses are given in the market. Given the way that the hypothesis of government expenditure, gave an instrument to showcase mediations, the model brings a value work into the market and gave uniformity of market

prices $\frac{p_j}{p_r}$ and budget equation for each school;

where

p_i is the price for the public good

p_j is the price for the private good

If the prices were used to advise on the total amounts the government should provide for a school, then government allocation to a school was presented as:

$$p_1 x_1^i + p_2 x_2^i + \ldots + p_n x_n^i = L_i \quad \ldots\ldots 3.10$$

Where

P is the market price for the public and private goods

L_i is the amount of government expenditure on education in a given school.

To build up the aggregate sum apportioned in a given school by the government, the allotment was increased by enrolment which was thought to be the yield accommodated a school that is identified with the usage of good x; subsequently, enrolment was along these lines introduced

as:

$$F_n = f(x_1,\ldots, x_m; x_n,\ldots, x_v; x_w,\ldots, x_z) \quad \ldots\ldots (3.11)$$

Where

$x_1,\ldots, x_m, x_n,\ldots, x_v, \quad x_w,\ldots, x_z$ represent school characteristics, enrolment, environmental infrastructure, and student ability

F_n is the level of enrolment.

Combining equation 3.5, 3.10 and 3.11 the output of a given school expressed by enrolment levels given government expenditure was given as:

$$F_n = x^i_{n+j} + L_i + \varepsilon_i \quad \text{.....(3.12)}$$

where F_n, L_i are explained in the model specification under equation 3.10, 3.11 and 3.12 and described as:

Where:

F_n s is the levels of enrolment and presented as enl

L_i is expressed as GE (Government expenditure)

x^i_{n+j} is expressed as X for cross-sectionals t at different panel time periods such that $(i)t = 1,..., N$ [1]

The model was consequently used to evaluate the effect of government use on the instruction division on levels of enrolment embraced Murphy, Shleifer, and Vishny (1991) and Yussuf (2006). In their models, challenges with the training part as a one-area model were delineated.

The investigations acquired from the old-style market analysts and were later embraced by Tandi (2013), Viscusi and Gayer (2015); Zoran (2015) and Soydan and Bedir (2015) where area profitability was subject to the generation capacities with the help of $[1, a]$ and the thickness work talked about by the

[1] The panel data in this study takes the pseudo panel that has homogeneity on cohorts studied. These pseudo panel takes care pf cohorts that have similar characteristics across various periods. The cross-sectional panel data is referred as pooled cross-sectional and analyzed as panel data (Verbeek, (2016).

Solow model. In the model plan, every segment was sorted out as a capacity whose yield (benefits) were given by given by:

$$y = sAF(H) - wH \quad \text{..3.13}$$

where:

y is the profits or outputs in a given school

s is the state of the economy,

A is the technological progress

F is the constant of enrolment over the time of production function,

H is the human capital and

w is the wage rate (expenditure)

The price of the goods produced was normalized to 1. Therefore, the model was analysed when the results were provided in the model integrated with respect to H .

3.3.1 Model Specification on Enrolment and Government Expenditure

When the constituents of X are disaggregated, equation 3.12 is thus specified as:

$$Enl_{(it)} = \beta_0 + \beta_1 GE + \beta_2 X_{it} + \varepsilon_{it} \quad \text{..(3.14)}$$

Where

X_i is a vector of observable variables that include school operations functions;

These factors incorporated included, the number of classes per school, number of toilets, accessibility of playfield, number of subjects per subject, school ownership list, school location, and class types

GE = is the government to expenditure a given school

$\beta_0, \beta_1, \beta_2$ are parameters to be estimated

ε_t is the disturbance term

3.3.2 Model Estimation on the effect of government expenditure on enrolment

Concentrates that utilized longitudinal panel, were relevant when similar measures are watched more than once after some time for similar people. The data sets collections were, by and large, viewed as unrivaled for recognizing connections among factors contrasted and different sorts of information. For this situation, people could be utilized as their own controls in panel models which are either fixed-impact (FE) models or Random Effect (RE) models to control for both watched and, all the more critically, surreptitiously time-consistent heterogeneities among various people. So as to break down the cross-sectional panel data that decided the impacts of government expenditure on enrolment. The model presented Fixed Effects in equation 3.14 such that:

$$Enl_{(it)} = \beta_0 + \beta_1 GE + \beta_2 X_{it} + \lambda_i + \varepsilon_{it} \quad \text{.....(3.15)}$$

Where

GE = is the government to expenditure a given school

i is the cross-section unit

λ_i is the fixed effect.

The fixed-impact model expected that the incline coefficients were steady for all cross-segment units while the whole number fluctuated over individual cross-section units. This result was required by the way that every indicator variable (for example the incline) was thought to be indistinguishable over every one of the gatherings and the relapse reports the normal without bunch impact Remarkably, in the event that an alternate regression was accomplished for each gathering, at that point there would be fluctuated inclines for each gathering which may not be reasonable. The equivalent could later be tried utilizing the Chow test if emphasis for between-group dummies and predictor factors are utilized in the regression If OLS was adopted, the estimates of $\beta's$ had to be BLUE (best linear unbiased estimates), thus the equations assumed that:

$E(GE/X) = X\beta$ and $E(S/X) = Z\beta$ ……...…… (3.16)

$E(Z\varepsilon) = 0$ ……..……...…..…. (3.17)

$E(\varepsilon\varepsilon) = \sigma^2 I$ ……..……..... (3.18)

Where

GE is

I = identity matrix, i.e. the error terms must be independent and identically distributed with zero means and variance σ^2.

GE = is the government to expenditure a given school

X is a vector of observable variables that include school operations functions;

These factors incorporate the number of classes per school, number of toilets, and accessibility of playfield, number of course readings per subject, school ownership file, area of the school and class types.

In addition, to ensure that random effects were addressed in the model, equation 3.15 had actual relations described by:

$$Enl_{(it)} = \beta_0 + \beta_1 GE + \beta_2 X_{it} + \lambda_i + \phi_i + \varepsilon_{it} \quad \text{(3.19)}$$

Where

ϕ = Is the school-specific unobservable determinants of enrolment.

Equations 3.18 assumed error term to be equal to:

$$\varepsilon_i = \phi_i + \mu_i \quad \text{(3.20)}$$

The error term in equation 3.19 integrated with the error term in equation 3.20 would lead to:

$$E(\phi_i . Z_i) \neq 0 \quad \text{(3.21)}$$

which would be a violation of the Gauss Markov Theorem. As a result, the OLS estimates $\beta's$ from equation 3.19 and 3.20 would be significant. To correct the violation, the OLS estimates applied were compared with the FE

analysis outlined in equation 3.15 and were likely to be biased. For each coefficient estimated, the omitted variables, therefore, followed the form:

$$\hat{\beta}_t = \beta_t + \frac{\text{cov}(x_i, X_i\gamma)}{\text{var}(x_i)} + \frac{\text{cov}(x_i, \phi)}{\text{var}(x_i)} \quad \text{..... (3.22)}$$

Where

$\hat{\beta}_t$ = is the estimated OLS coefficient for the government expenditure while β_t is the true effect of government expenditure on enrolment.

Given the confinements that exist when an investigation is made under the OLS tests, the model attempts the Haussmann tests which help to beware of whether to utilize the Fixed Effects (FE) or Random Effects (RE) on cross-section panel data. The Haussmann test embraced the pseudo-panel form clarified as:

$$chi\,2(2) = (b - \beta)'[v\_b - V\_\beta) \wedge (-1)](b - \beta) \quad \text{.....(3.23)}$$

Where

$chi(2)$ is positive for Fixed Effects (FE) unlike under the Random Effect (RE) which is negative.

The utilization of xt from the tests furnished positive connections and furthermore worked with pseudo panels. This was not quite the same as the period when the model worked under the OLS model where the utilization of accommodating in secret impacts. Along these lines, the in secret

heterogeneity is tended to under the panel analysis for the FE examination model. The panel test in this manner applied which excludes collinear factors.

3.3.3 Definition and Measurement of Variables

Estimation of the model determined in condition 3.23 was attempted utilizing fixed-effect investigation. The model set up answers to the objective on, the impact of government expenditure on enrolment and applied the accompanying factors recognized in Table 3.1.

This was not quite the same as the period when the model worked under the OLS model where the utilization of accommodating in secret impacts. Along these lines, the in secret heterogeneity is tended to under the panel analysis for the FE examination model. The panel test in this manner applied which excludes collinear factors.

Estimation of the model determined in condition 3.23 was attempted utilizing fixed-effect investigation. The model set up answers to the objective on the impact of government expenditure on enrolment and applied the accompanying factors recognized

Table 3.1: Variables for Government Expenditure and Enrolment

Variable	Definition	Measurement	Apriori Expected effect
Dependent Variable			
Enrolment	Number of boys and girls enrolled in a primary school	Number in Units	
Independent Variables			
School infrastructural characteristics	Number of classes in a school Number of toilets in a school Availability of playfield in the school Number of textbooks for different subjects in a school School Possession index	Number in units Number in units Number in units Number in units Possession Index from secondary data	Positive Positive Positive Positive Negative
Government Expenditure	Amount of recurrent and development used to finance education provided by the government to a given school	Kenya Shillings calculated by capitation basis per child enrolled	Positive
Regional characteristics	School location described by level of urbanization School Distance to social amenities	Dummy measures based on the location of the school either: 1 if big town, 0 otherwise; 1 if urban, 0 otherwise; 1 if rural, 0 otherwise; or 1 if isolated, 0 otherwise Dummy measures based on the distance to social amenity either: 1 if clinic, 0 otherwise; 1 if road, 0 otherwise; 1 if Library, 0 otherwise; 1 if Bookshop, 0 otherwise; 1 if Secondary school, 0 otherwise; or 1 if market, 0 otherwise.	Positive Positive
Class types	Number of classes described by building type	Dummy measure based on building material either given as: Permanent=1, wise zero; Temporary=1, otherwise 0 or Open=1, otherwise 0	Positive

Source: Authors Definitions

3.4 Theoretical Framework on Government Expenditure and Quality of Education

This segment depicted the theory that was utilized to discuss objective two of the study. The goal clarified the effect of government expenditure on the education quality communicated by math and reading scores. The segment additionally utilized human capital theory at the purpose of discussing model specifications

In the model improvement, the study expected that children invested some portion of their energy in relaxation h_l which is adaptable and along these lines regards them as a continuous choice variable. The human capital production function, thusly, took the structure:

$$H = h(h_l; h_s) \text{ where } \frac{\partial H}{\partial h_l} < 0 \quad \text{.....(3.24)}$$

Where

H is the human capital achieved explained in equation 3.13

h_l is the time spent in leisure

h_j is the time spent in school

For this situation, human capital formation in a school is utility accomplished from the production function which was characterized over the present utilization by children joined up with schools, the present relaxation appreciated by children and levels of human capital accomplished. At the

point when the human capital is identified with family unit commitment in its obtaining, at that point, current family utilization c_1 was given by

$$c_{1s} = y + wh_l - q \quad \text{.....(3.25)}$$

Where

y is the expenditures on education

h_l are the hours of leisure

w is the cost of hours of leisure assumed as the wage rate

q is the direct cost of education

Relating equation 3.24 and 3.25, the education quality accomplished compares to the aggregate of human capital accumulation which was characterized as the knowledge obtained by students enrolled at a given school and communicated

as:

$$c_{2s} = K + H \quad \text{.....(3.26)}$$

Where

K is the exogenous endowment of human capital

H is defined in equation 3.13

Following condition 3.26, the school condition encouraged human skill acquisition through communication with an arrangement, for example, playing

field which likewise appended an incentive to relaxation delighted in by students in a given school

expressed as:

$$L = 1 - h_s - h_l \quad \text{.....(3.27)}$$

Where L

and time is normalised to 1.

The parents' choice for learner enrolment of h_l (in a situation where children are in school) was thus given as:

$$\max \left[\mu_s * (h_l), \mu_l * (h_l)\right] \quad \text{.....(3.28)}$$

Where

$$u_s^* = \max_{h_l} u\,(y + wh_l - q, K + H(h_l; h_s), 1 - h_s - h_l; M) \quad \text{.....(3.29)}$$

The expression in equation 3.29 showed that at this point μ is regarded as the amount of human capital acquired expressed in terms of test scores. Therefore, the scores acquired were expressed as:

$$Scores_l^* = \max_{h_l} scores\,(y + wh_l - K, 1 - h_l; M) \quad \text{.....(3.30)}$$

Where M represent the attributes identified with the quality of education acquired, teacher education, and teacher experience and school qualities among different factors.

3.4.1 Model Specification for Government Expenditure and Quality of Education

In the expression provided in condition 3.29, and embracing Hanushek (2003); Kings et al., (2007) and Taylor et al., (2000) this examination related the models to Todd and Wolpin (2003), Rugiero (2004), De Witte and López-Torres (2015), Thieme et al., (2012); Sotiriadis (2016); Kumar and Choudhary (2019) and Bashir and Amir (2019) who built up a model where human capital capacity was controlled by scores obtained expressed as:

$$Scores_{l}^{*} = \max_{h_l} scores\ (y + wh_l - K, 1 - h_l; M) \quad \text{.....(3.31)}$$

The structure introduced in condition 3.31 received different factors, for example, pupil qualities, school attributes and government expenditure as variables that decided score levels:

Where

$$Score_{ijk} = c + \sum_{k-1}^{N_x} \alpha_k x_k + \beta_1 Z_{jt} + \beta_2 Y_{jt} + X_{jt} + \sum_{t=2000,2004,2012,} D_t + \varepsilon_{ijt} \quad \text{.....(3.32)}$$

i, j, t are indices for the total pupil i, enrolled in school j at time t

N_x is the number of schools that explained as the control variable x

X_t is the school observable characteristics as defined in equation 3.13

z_{jt} is the Pupil and Teacher related characteristics

Y_{jt} is the government expenditure

D_t are dummies for 2000, 2004 and 2012

To facilitate the accomplishment of objective two in this study, condition 3.32 was improved to incorporate the stock of human capital obtained communicated as aggregated school scores in arithmetic and reading for schools situated in regions including rural, urban, big town or isolated. The schools had explicit factors that were utilized to decide the various scores henceforth the model was assessed

as:

$$S_{jtk} = \alpha + X^{d}_{jt}\gamma + X^{s}_{jt}\mu + D_t \in_{jtk} : t = 1, 2, 3, k = 1, 2 \; ; \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.33)$$

Where

S_{jtk} =the average score on the class six SACMEQ test on arithmetic and comprehension, k for school j in year t.

X^{d}_{jt} = specific observable variables for school i in year t that include the number of classes, number of toilets, availability of playfield, number of textbooks, school possession index, location of the school and class types.

X^{s}_{jt} = school-specific variables for school j in year t :

γ and μ are vectors of parameters to be estimated, α is the intercept and $\in$ is an iid disturbance term.

3.4.2 Model Estimation on the Effect of Government Expenditure on Quality of Education

The assessed model to build up the effect of government expenditure on the quality of education receives the structure utilized in Thieme et al., (2012); De Witte and Lopez-Torres, (2015); Sotiriadis, 2016, Republic of Kenya (2019) and Bashir and Amir (2019). In the model, a relationship between the normal school performance and different attributes were constructed and introduced as:

$$S_{jtk} = \alpha + X^{d}_{jt}\gamma + X^{s}_{jt}\mu + Z_{jt}\beta + (Z_{jt} * X_{jt})\delta + (E_{jt} * X_{jt})\varphi + \in_{jtk} \ldots\ldots (3.34)$$

The assessed model in condition 3.34, guaranteed impromptu factor incorporation and seeing along these lines tending to the connection between government expenditure and education quality. This study, accordingly, adopted a log-linear model given that all observations were positive (McGraw, 1995). The model was in this manner written as:

$$\ln S_{jtk} = \alpha + d\ln X_{jt}\gamma + s\ln X_{jt}\mu + \ln Z_{jt}\beta + \ln(Z_{jt} * X_{jt})\delta + \ln(E_{jt} * X_{jt})\varphi + \in_{jtk} \ldots\ldots (3.35)$$

Where

$Z_{i(t),t}$ =a vector of observable variables including pupil and teacher characteristics that included pupil-teacher ratio, pupil-class ratio, pupil –book ratio, pupil-toilet ratio, and teacher experience. These observable variables were presented as:

$$X_{jt} = (X^{d}_{jt}, X^{s}_{jt}) \ldots\ldots (3.36)$$

Which explains variables defined in equation 3.14, 3.32 and 3.33.

With the adoption of the model explained in equation 3.36, the equation assumed that the parameter vector β is closely related to scores with a positive sign and the vector parameter δ and φ captures interaction effects during analysis.

3.4.3 Definition and Measurement of Variables

Estimation of pseudo-panel cross-section data while establishing the effect of government expenditure on enrolment will apply variables identified in Table 3.2.

Table 3.2: Variables to Establish the Impact of Government Expenditure on Quality of Education (Additions

Variable	Definition	Measurement	Apriori Expected effect
Dependent Variable			
Performance Scores	Mean test score in arithmetic, reading	Number of scores	Positive
Independent variables			
Pupil characteristic	Teacher-pupil Ratio	Number of pupils per teacher	Positive
	Class-pupil Ratio	Number of pupils per class	Positive
	Book-pupil Ratio	Number of pupils per one textbook per subject studied	Positive
	Toilet-pupil ratio	Number of pupils per toilet	Positive
Teacher characteristics	Total number of teachers in school	Number in Units	Positive
	Teacher Experience expressed by the number of years of teaching	Number of teachers with (a) no experience (b) less than 1 year (c) at least 1 year (d) at least 2 years (e) at least 3 years (f) more than 3 years	Negative
	Teacher Qualification by the level of training	Number of Teachers with (i) primary education (ii) Secondary education (iii) tertiary education	Positive

Source: Authors definitions

3.5 Production Theory

This area addressed objective three of the study that clarified degrees of technical efficiency as the third indicator of school performance and related determinants of effectiveness. The goal applied production theory to decide the effect of government expenditure on school technical efficiency. The investigation adopted the Data Envelopment Analysis (DEA) model to build up levels of efficiency and censored the Tobit model to explain variables contributing to inefficiency among schools.

3.5.1 Production Theory and Government Expenditure

The production function in a school that clarified school operations in aptitude improvement took the cobb-Douglas model structure. What's more, the functional form of the model was increasingly explicit to the principle instinct. The after-effects of the model were expressed as:

$$Q = AE^{\alpha} R^{\beta} \quad \forall \alpha + \beta \leq 1 \text{ . } \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.37$$

Where

Q are the inputs to school score

(A) are school characteristics

(E) Student characteristics

(R) and government expenditure

In this study, schools were perfectly homogeneous to provide overall performance in the education sector. The design of the model followed that

inputs to school scores Q were dependent on school characteristics (A), student characteristics (E), and government expenditure (R). Further, student characteristics were exogenous in the model and government expenditure was dependent on school enrolment levels. The parameters α, β were elasticities of the schooling quality of education Q, school characteristics (A), student characteristics (E), and government expenditure (R). Deriving the equation from a cobb-Douglas function in the education sector, it follows that the characteristics of the school, teachers, and student-related characteristics interact positively with government expenditure respectively.

So as to indicate the definite model for this study, the key confirmation process should have been attempted. Accordingly, the production function used to answer this objective took three significant efficiency models into consideration. These incorporated the deterministic model, stochastic frontier model or panel data model. The three models clarified that the output Y was meant by which was thought to be communicated as far as a result of a known capacity of a vector X. The vector X was gotten from the impact of production and a function of unobservable random variables and stochastic errors. The deterministic frontier model laid out by Daraio and Simar (2005); Raposo and Menezes (2011); De Witte and López-Torres (2015); Cordero-Ferrera et al., (2015); Baqaee and Farhi (2017), and Johnes et al., (2017) who noticed that the underlying model shaped establishment of different models created. Given its pioneer structure, the model, thusly, shaped a premise of a productivity model utilized in the investigation defined as:

$$Y_i = f(x_i : \beta)\exp(-\mu_i),\ i = 1,2,\ldots N \quad \text{.....(3.38)}$$

Where

Y_i is the possible production level for i^{th} sample function.

$f(x_i : \beta)$ is a suitable function of the vector

x_i is the number of inputs for i^{th} school/firm and of unknown parameters

μ_i is the non –negative random variable with school-specific functions that contribute to the i^{th} school not attaining a maximum efficiency of production.

N represent the number of schools involved in a cross-sectional summary of the education sector.

Y_i Is bounded above by the deterministic quantity $f(x_i : \beta)$ hence equation 3.38 is deterministic production function with inequality relationship given as:

$$Y_i \leq f(x_i : \beta), i = 1,2,\ldots N \quad \text{..... (3.39)}$$

The production model displayed in condition 3.39, clarified that technical efficiency was given by a factor by which the degree of production for a school was not as much as its frontier input. Given the deterministic function model in equation 3.39, the output in the i^{th} school was given as:

$$Y_i^* = f(x_i : \beta) \quad \text{.....(3.40)}$$

and thus technical efficiency is expressed as:

$$TE_i = \frac{Y_i}{Y_i^*}$$

$$= f(x_i : \beta) \exp \frac{(-\mu_i)}{f(x_i : \beta)}$$

$$= \exp(-\mu_i) \quad \text{..... (3.41)}$$

3.5.2 DEA Model for Technical Efficiency Measurement

Following condition 3.41, the application of the DEA approach to deal with technical efficiency was characterized as a distance function estimation which was non-parametric. The model included a linear programming method that is utilized to build a frontier over points that either on or below the production possibility frontier for school productivity (Simar and Wilson, 2007; Baqaee and Farhi, 2017; Johnes et al., 2017). Given that government expenditure was used as a determinant of school performance then, output-oriented DEA was highly

The DEA mathematical model was thus defined as:

$$P_c = \left\{ (x, y) \mid x \geq \sum_{j=1}^{n} \lambda_j x_j, y \leq \sum_{j=1}^{n} \lambda_j y_j, \lambda_j \geq 0, j = 1,..., n \right\} \text{..... (3.42)}$$

Where

x_j And y_j are the input vectors and output vector of $school_j$ respectively.

In model definition, consider n schools and each uses m inputs such that $x_{ij} (i = 1,..., m)$ to produce s outputs $y_{rj} (r = 1,..., s)$ assuming that all inputs and outputs were non-negative.

As indicated by the definition given, the Production Possibility Set (PPS) was displayed as the arrangement of all inputs and outputs in the production

technology set in which outputs were delivered from the inputs. Under the Constant Returns to Scale (CRS) presumption, in this way, the PPS was determined.

To gauge the efficiency of schools utilizing DEA, this study embraced the CCR model during the 1970s. The CCR model was a radial model where the relative difference in inputs or outputs was the primary concern (Simar and Wilson, 2007; De Witte and Lopez-Torres, 2015; Sotiriadis, 2016; Johnes et al., 2017). As discussed in equation 3.42, the CCR was indicated as:

$$\begin{aligned} &\theta^{*} = \min \ \theta \\ &s.t \sum_{j=1}^{n} \lambda_j x_{ij} \leq \theta x_{ik}, i = 1,..., m, \\ &\sum_{j=1}^{n} \lambda_j y_{ij} \geq x_{ik}, i = 1,..., s, \\ &\lambda_j \geq 0, \ j = 1,..., n, \theta free \end{aligned} \quad \text{..... (3.43)}$$

Where the optimal solution θ^{*} was an efficiency score. In this study, a school was said to be efficient if $\theta^{*} = 1$ and inefficient if $\theta^{*} < 1$.

Further, let X be a $m * k$ matrix of inputs that are constructed from a vector of inputs, x_i, in k schools. The expression developed provided that Y denoted a $n * k$ matrix of outputs, y_i, of the k schools. The output-oriented variable returns to scale (VRS) frontier was thus expressed as:

$$Min \ \theta$$

$$\theta, \lambda$$

Subject to $-y_i / \theta - Y\lambda \geq 0$

$x_i - X\lambda \geq 0 \quad kI'\lambda = 1 \quad \lambda \geq 0$ ..... (3.44)

Where $k1$ is a $N * 1$ vector of $1s, \lambda$ is and a $k * 1$ vector of weights while θ was the output distance measure which is between 0 and 1. In this respect, $1/\theta$ are the levels of efficiency scores by which output of i^{th} school could be expanded while keeping input quantities constant.

3.5.3 Definition and Measurement of Variable for Technical Efficiency

In analysing school technical efficiency level and the respective determinants of inefficiency various inputs and outputs used in the study were shown in Table 3.3.

Table 3.3: Inputs and Outputs for Technical Efficiency Analysis

Study Inputs		
Input	**Definition**	**measurements**
(i) Total Teachers	Number of teaching staff in a given school	Number in units
(ii) Enrolment levels	Number of pupils enrolled in a given school	Number in units
(iii) Total Classes	Number of infrastructures for reading used as classes in a school	Number in units
(iv) Total toilets	Number of toilets are in a given school	Number in units
(v)Government expenditure	The total amount of transfers that include recurrent and development allocations made to the school for all pupils enrolled	Kenya Shillings
Study Outputs		
Outputs	**Definition**	**Measurements**
(i) Test scores in Arithmetic	The measure of the level of skill acquired by pupils in Arithmetic	Mean Scores/800
(ii) Test scores in reading	The measure of the level of skill acquired by pupils in reading	Mean Scores/800

Source: Authors definitions

3.5.4 Determinants of Efficiency

Factors adding to inefficiency in schools were dictated by the study applying a censored Tobit model. The standard condition in the Tobit model utilized in the investigation was laid out by Woodridge (2010) was introduced as:

$$y_i^* = x_i\beta + \varepsilon_i \quad \text{.....} \quad (3.45)$$

Where

$$\varepsilon_i \approx N(0, \sigma^2)$$

y^*=a latent variable that was observed for values greater that than τ and censored otherwise

The observed y was thus defined by the following measurement equations:

$$y_i = \begin{cases} y^* & y^* > 0 \\ if & \\ \tau y & y^* \leq 0 \end{cases} \quad \text{.....} \quad (3.46)$$

In the typical Tobit model, it was assumed that $\tau = 0$ i.e. for data censored at 0, thus:

$$y_i = \begin{cases} y^* & y^* > 0 \\ if & \\ 0 & y^* \leq 0 \end{cases} \quad \text{.....} \quad (3.47)$$

3.5.5 Model Specification for Determinants of Efficiency

The empirical censored Tobit model that was used to establish determinants of efficiency in equation 3.46 was adopted from Woodridge (2010) and took the form:

$$y = \begin{cases} 1 \\ 0 \end{cases} if \quad y > 0 \qquad \text{......} \qquad (3.48)$$

Where y is the inefficiency score that had been achieved from equation 3.36.

By introducing a latent variable y_i^* then,

$$E(y_i^* | x) = x_i^{'}\beta$$
$$y_i^* = x_i^{'}\beta + \varepsilon_i \qquad \text{......} \qquad (3.49)$$
$$\varepsilon_i \approx i.i.d.N(0, \sigma^2)$$

$$y_i = \begin{cases} y_i^* & if \quad y_i^* > 0 \\ 0 & \quad\; y_i^* \leq 0 \end{cases}$$

And $\{x_i, y_i) : i = 1,2,.3\}$

Where x_i were the various variables used to determine the levels of efficiency levels in the model

The censored observation then became:

$$pr(y_i = 0) = pr(y_i^* \leq 0$$
$$= pr(\varepsilon_i \leq -x_i^{'}\beta) = pr(\frac{\varepsilon_i}{\sigma} \leq -\frac{x_i^{'}\beta}{\sigma}) \qquad \text{......} \qquad (3.50)$$
$$= \phi(-\frac{x_i^{'}\beta}{\sigma}) = 1 - \phi(\frac{x_i^{'}\beta}{\sigma})$$

3.5.6 Model Estimation for Censored Tobit Analysis for determinants of Efficiency

The efficiency levels accomplished through the output-oriented variable returns to scale (VRS) frontier communicated in condition 3.50 was assessed to decide efficiency using the Non-parametric linear programming approach. This methodology adopted the Data Envelopment Analysis (DEA) model assumed that all the deviations from the frontier were due to schools' inefficiency. In TE under time periods t=1… T and the production technology at time t was P^t, then $P^t = \{(x^t, y^t) : x^t$ can produce $y^t\}$. The changes in productivity over time, two time periods that produced the above results were defined as: $D_0^t(x^{t+1}, y^{t+1}) = \min\{\theta : x^{t+1}, y^{t+1}/\theta \in P^t\}$ at time t and $D_0^{t+1}(x^t, y^t) = \min\{\theta : x^t, y^t/\theta \in P^{t+1}\}$ at time t+1. Estimation for determinants of inefficiency expressed in equation 3.50 adopted the censored Tobit model. The Censoring occurred when the value of observation was only partially known or occurred outside the range of a measuring instrument. The perceptions outlined out in the outcome were either disaggregated by realizing the definite worth applied or in conditions where the qualities existed either above or below a given threshold (for upper and lower censoring respectively).

3.5.6 Definition and Measurement of Variable for Determinants of Efficiency

Variables that are used for identifying determinants of efficiency in equation 3.50 adopted part of variables in table 3.3 as well as the variables presented in Table 3.4

Table 3.4: Variables used for Measuring Determinants of Efficiency

Variable	Definition	Measurement	Apriori Expected effect
Dependent Variables			
Inefficiency Scores	An efficiency score below 1	Scores <1	
Independent variables			
Government Expenditure	Amount of recurrent and development allocation to finance education provided by the government to a given school	Kenya Shillings calculated from capitation amounts	Positive
Pupil characteristics	Teacher-Pupil Ratio Teacher -Pupil Ratio Book-Pupil Ratio Toilet-pupil ratio	Number of pupils per teacher Number of pupils per class Number of pupils per book Number of pupils per toilet	Positive Positive Positive Negative
Teacher characteristics	Total number of teachers in school Teacher Experience expressed by the number of years of teaching Teacher Qualification by the level of training	Number in Units Number of teachers with (a) no experience (b) less than 1 year (c) at least 1 year (d) at least 2 years (d) at least 3 years (e) more than 3 years Number of Teachers with (i) primary education (ii) Secondary education (iii) tertiary education	Positive Positive Positive
Class types	Number of classes described by building type	Dummy measure based on building material either given as Permanent=1, wise zero; Temporary=1, otherwise 0 or Open=1, otherwise 0	Positive
Regional characteristics	School location described by its level of urbanization School Distance to social amenities	Dummy measures based on the location of the school either: 1 if big town, 0 otherwise; 1 if urban, 0 otherwise; 1 if rural, 0 otherwise; or 1 if isolated, 0 otherwise Dummy measures based on the distance to social amenity either: 1 if clinic, 0 otherwise; 1 if road, 0 otherwise; 1 if Library, 0 otherwise; 1 if Bookshop, 0 otherwise; 1 if Secondary school, 0 otherwise; or 1 if market, 0 otherwise.	Negative Positive
Teacher Qualifications	Levels of education completed by the teachers	Number of teachers with (i) Primary school education (ii) Secondary school education (iii) Professional qualifications	Positive

Source: Authors definitions

3.6 Study Area Profile

The study covered all 47 counties in Kenya disaggregated in 8 regions and covered the assessment undertaken by the Ministry of Education under the SACMEQ study. The factors considered in the investigation included government expenditure, pupil and school-related qualities in the three-timeframes The times frames included, the period before the FPE implementation, the period during which expenditure in education was shared among households and government; the subsequent period was following the execution of the FPE program and the third time frame which was 8 years after the FPE program was seen to have stabilized. The three-timeframes were useful to determine the impact of government expenditure on school performance in different financing periods with various structures in expenditures.

3.7 Target Population

The study has identified all primary schools in the 47 counties and identified the 13,404 public primary schools in 2000; 14,708 and 18,954 public primary schools 2004 and 2012 respectively.

3.8 Sample Size and Sampling Technique

An aggregate of 174, 173 and 181 open elementary schools were tested in the SACMEQ assessment process in 2000, 2004 and 2012 individually from the 47 counties Kenya's 8 regions in Kenya. The sampled sizes were summarised as per the Constitution of Kenya (2010) as presented in Table 3.5.

Table 3.5: Sample Size for the Regions and Schools included in the Study

Region No.	Name of region	Number of Counties per region	Counties represented
1	Coast Region	5	Taita Taveta, Kilifi, Tana River, Kwale, Mombasa
2	Central Region	7	Nyandarua, Kirinyaga, Nyeri, Muranga, Kiambu, Laikipia, Nyandarua
3	Eastern Region	7	Machakos, Kitui, Embu, Meru, Isiolo, Makueni, Marsabit
4	Nairobi Region	1	Nairobi
5	Rift Valley Region	13	Turkana, Samburu, Trans Nzoia, West Pokot, Uasin Gishu, Bomet, Nakuru, Kericho, Nandi, Kajiado, Narok, Baringo, Elgeyo Marakwet
6	Nyanza Region	6	Kisumu, Kisii, Homabay, Siaya, Nyamira, Migori
7	Western Region	5	Busia, Bungoma, Kakamega, Vihiga
8	North Eastern Region	3	Garissa, Wajir, Mandera
	Total	47	

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012

3.9 Data Collection Procedure

The study utilized secondary data gathered from different sources including the United Nations Education, Scientific, and Cultural Organization (UNESCO) and Statistical Abstracts for the year 1996/7 to 2017/18. The information was cross-section pseudo-panel data.

Data gathered from UNESCO was sourced from the International Institute for Educational Planning (IIEP) that was exhibited under the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SAECMEQ). The SAECMEQ is an undertaking of UNESCO's International Institute for Educational Planning (IIEP). The SACMEQ assessment was attempted in three timeframes and distinguished as SACMEQ I, II and III for the years 2000, 2004 and 2012. The assessment procedure included class six pupils in the examined schools. The data collected covered a school-based cross-section survey that planned for monitoring the quality of education in an uncontrolled domain. The data covered geographically diverse county and national representation covering both rural and urban regions in Kenya within the in 47 counties. The review likewise secured a few qualities including pupil attributes, school-based qualities just as an individual teacher and family units' attributes.

Data on government expenditure and particular school enrolment for the years were gathered from various statistical abstracts. The data covered three timeframes; the period around 2000 preceding the implementation of Free Primary Education (FPE), the period in 2004 which was one year after the FPE Implementation while the year 2012 was a fairly steady period after the execution of FPE program. The three data sets had different sample sizes apparently given that the number of schools reached was distinctive every year. Pertinent factors explicit to the study were extricated from the data sets, coded and applied in analysis utilizing STATA and DEAP statistical package

3.10 Data Processing and Analysis

Before estimation, data entry and data cleaning from the extracted data was attempted. From that point, model specification tests were completed. Be that as it may, a few impediments identified with the relationship were faced during the estimation and analysis of the first and second objectives. The restrictions included potential selection bias, potential endogeneity, and potential unobserved heterogeneity. Important, sample selection bias in much of the time emerged when or not schools are situated in urban or rural regions. This confinement was accommodated if the school area was very much distinguished. Moreover, if unobserved variables that impacted school location were corresponded with unobservable elements and the impact of education quality, at that point choice selection bias would almost certainly emerge. Further, selection bias was tended to utilizing the Olsen model to control for the selection bias which applied Ordinary Least Squares (OLS) regression in the first step. The model utilized was unique in relation to the Heckman model where an iterate probit analysis was considered in the initial step examination (Greene, 2010).

While the tests were embraced, in the event that covariate for education quality achieved was potentially endogenous to some extent, then the quality of education became a decision variable (Guevara and Ben-Akiva, 2013). On the other hand, if unobservable elements that impacted school choice were related to education quality accomplished, at that point, the measurement was estimated was said to be inconsistent and could not have causal interpretation (Cameron and Trivedi, 2010). In this manner, the endogeneity issue recognized in the test investigation was embraced and controlled for utilizing a

Two-Stage Residual-Inclusion (TSRI) model (Terza, Basu and Rathmouz, 2008). The TSRI approach included in determining regressors that expressed an equation for quality of education and gave residuals that showed endogeneity. The last would be conceivable if residuals were measurably huge.

It was additionally expected that heterogeneity existed in the analyzed data if there were some unobserved variables that cooperated non-straightly with school decisions that influenced education quality (Greene, 2010). To control for unobserved heterogeneity, the interaction between quality of education and related residuals were added as additional regressors in the equation. Hence, unobserved heterogeneity was said to exist in the model if the coefficient for extra regressors was factually critical (Mwabu, 2009).

The probabilities observed tended to the presence of omitted factors, measurement error and simultaneously resulted in some levels of endogeneity. To take care of this issue, Haussmann tests were applied in the data tests to decide if a portion of the omitted factors were included in the regression model leading to bias. Furthermore, data robustness was tested using pedagogical cohorts or a sample that would be more increasingly spurred for over or underestimation of the push to utilize the information.

While analyzing objectives one and two, pseudo-panel data estimation took into consideration the heterogeneity of individual cross-section units. The progressions were occasioned by taking into account individual-specific fixed effects that gave more variability and degrees of freedom.

In summary, normality, heterogeneity and endogeneity tests were completed regardless of data size. The third objective embraced a non-parametric measure for technical efficiency estimation utilizing the DEA model. Moreover, reasons for inefficiency were resolved determined through a second stage analysis by applying a censored Tobit regression model.

3.11 Diagnostic Tests

3.11.1 Diagnostic Tests for Heteroscedasticity

The test for heteroscedasticity was undertaken using Breusch-pagan and Cook-Weisberg test to manage circumstances where the dependent variable was unequal across the values of an independent variable. The null hypothesis of the heteroscedasticity was that the error terms were homoscedastic, that is, the variance of the error terms is constant against the alternative hypothesis that the errors were heteroscedastic; that is, the error terms had no constant variance. Thus, if the P-value of the chi-square was less than 0.05, then the null hypothesis was rejected (Greene, 2010; Hansen, 2012, and Woodridge, 2010).

3.11.2 Diagnostic Tests for Multicollinearity

Multicollinearity in data affected econometric framework including standard errors which were large even if the underlying specification was correct. In this study, the test for multicollinearity was undertaken using the Variance Inflation Factors (VIF)[2] . In testing for VIF, the null hypothesis was that the coefficient of a variable is zero. Therefore, if t-statistics was less than 1, and in

[2] **VIF** measure how much the variance of the estimated regression coefficients are inflated as compared to when the predictor variables are not linearly related. It is used to explain how much amount multicollinearity (correlation between predictors) exists in a regression analysis

turn, a p-value was well above a traditional α=0.05 cut-offs, then, a predictor that was in the model would be overlooked, since the model would fail to reject the null hypothesis if it was equal to zero (i.e., not significant).

3.11.3: Testing for Fixed Effects and Random Effects for the Pseudo – Panel Analysis

A decision to adopt either fixed or random effects for pseudo-panel data was undertaken using the Hausman test where the null hypothesis was that the preferred model had random effects, that is, 'variables were not significantly correlated with the explanatory variables. Further, the alternative hypothesis was that the variables had fixed effects (Green, 2008). The fixed effect and random effect test determined if the unique errors (ui) were correlated with the regressors, and thus, the null hypothesis explained that they were not, and thus a decision to reject the null hypothesis if Prob>chi2<0.05 was adopted.

CHAPTER FOUR
EMPIRICAL FINDINGS

4.1 Introduction

This chapter presents the empirical findings of the study. The summary statistics are presented in section 4.2; while results on diagnostic tests are presented in section 4.3. Regression analysis results on enrolment and quality of education are presented in sections 4.4, 4.6 and 4.7. Further, efficiency analysis results and respective determinants of efficiency were presented in section 4.7.

4.2 Summary Statistics

Summary statistics for the variables used in the study were presented in Table 4.1, Table 4.2, Table 4.3, Table 4.4, Table 4.5, Table 4.6, Table 4.7, Table 4.8, Table 4.9, Table 4.10, Table 4.11, Table 4.12, Table 4.13 and Table 4.14.

Table 4.1: Number and Percentage of Schools Sampled

Region Number	Name of region	Number of Counties	Counties represented	Year of SACMEQ evaluation and Number of schools			Mean	Standard Deviation
				2000	2004	2012		
1	Coast	5	Taita Taveta, Kilifi, Tana River, Kwale, Mombasa	22 (12.6%)	18(10.4%)	15(8.3%)	18.3	3.51
2	Central	7	Nyandarua, Kirinyaga, Nyeri, Muranga, Kiambu, Laikipia, Nyandarua	35(20.1%)	24(13.9%)	23(12.7%)	27	6
3	Eastern	7	Machakos, Kitui, Embu, Meru, Isiolo, Makueni, Marsabit	24(13.8%)	23(13.3%)	22(12.2%)	23	1
4	Nairobi	1	Nairobi	19(10.9%)	19(10.98%)	15(8.3%)	17.7	2.3
5	Rift Valley	13	Turkana, Samburu, Trans Nzoia, West Pokot, Uasin Gishu, Bomet, Nakuru, Kericho, Nandi, Kajiado, Narok, Baringo, Elgeyo Marakwet	24 (13.8%)	28 (16.2%)	38 (20.99%)	30	7.2
6	Nyanza	6	Kisumu, Kisii, Homabay, Siaya, Nyamira, Migori	20 (11.5%)	23 (13.3%)	34 (18.8%)	25	7.4
7	Western	5	Busia, Bungoma, Kakamega, Vihiga	15 (8.62%)	24 (13.9%)	22 (12.2%)	20	4.72
8	North Eastern	3	Garissa, Wajir, Mandera	15 (8.6%)	14 (8.1%)	12 (6.6%)	13.7	1.53
	Total	47		174 (100%)	173(100%)	181 (100%)	176	4.35

Source: Authors Computation Based on SACMEQ Survey data, 2000, 2004 and 2012 from

In Table 4.1, the number of schools sampled for the study was 174, 173 and 181 for the years 2000, 2004 and 2012, respectively. In 2000, 35 (20.1 percent) of the schools sampled were from the Central region while 24 (13.8 percent) were sampled from Eastern and Rift Valley regions respectively. In 2004, the Rift valley region had the highest number of schools sampled at 24(16.2 percent) with both Eastern and Western regions having 24(13.9 percent) of schools sampled. However, in 2012, the Rift valley region had the highest number of schools numbering 38(20.99 percent) sampled, while Nyanza region had 34 (1.8 percent) and while Central, Eastern, the Western region had 22 (12.2 percent) of the schools sampled respectively. Table 4.2 presented the mean and standard deviations for government expenditure per school in the eight regions for the period 2000, 2004 and 2012.

Table 4.2: Summary statistics for Government Expenditure per school by region

	2000		2004		2012	
Region	**Mean (KES)**	**Standard Deviation (KES)**	**Mean (KES)**	**Standard Deviation (KES)**	**Mean (KES)**	**Standard Deviation (KES)**
Central	1,030,890	660,276.2	769,811.8	296,505.6	480,274.6	220,284.8
Coast	939,129.5	752,259.7	737,702.0	356,629.7	703,215.3	361,027.2
Eastern	569,264.0	287,237.9	530,759.0	256,185.5	413,787.2	217,930.1
Nairobi	1,205,449	364,168.5	1,216,258.0	398,010.6	1,282,608	552,954.5
North Eastern	826,018.7	478,641.5	1,058,135.0	643,337.2	171,800.5	32,021.6
Nyanza	543,366.1	339,848.0	518,805.4	405,103.6	484,393.8	254,402.5
Rift valley	663,115.8	264,743.3	650,955.2	273,526.7	610,123.5	337,802.0
Western	867,895.6	556,341.1	7,080,391.0	342,887.2	723,979.5	357,703.4
National Mean	5,614,238		12,562,818		4,870,182	

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004 and 2012; Statistical Abstracts, 1998; 2002;2006;2010;2014;2018

Table 4.2 showed that the overall mean government expenditure per school increased between 2000 and 2004 with the establishment of FPE and dropped significantly after the FPE programme stabilized in 2012. The results provided in Table 4.2 were supported by a study done by Japan International Cooperation Agency (2012) on the basic education sector, which found that budgetary conveyance to the training division had been generally high before the Free Primary Education program. In any case, the report showed that just about 80 percent of expenditures on education were apportioned to teacher pay and the portion of primary education was as low as 5.4 percent, (Republic of Kenya, 2002; 2006; 2010; 2014; 2018). The resources provided were utilized in schools across the eight regions whose mean enrolments are presented in Table 4.3.

Table 4.3: Summary Statistics for Enrolment per School in Given Regions

Region	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**
	2000		**2004**		**2012**	
Central	728	429.05	598	230.21	516	236.57
Coast	536	243.81	573	276.89	753	387.78
Eastern	427	215.97	412	198.9	444	234.08
Nairobi	706	273.8	944	309.01	1,378	593.94
North Eastern	621	359.88	822	499.49	785	334.39
Nyanza	409	255.5	403	314.52	520	273.25
Rift valley	499	199.06	505	212.21	655	362.83
Western	523	189.58	550	266.22	778	384.21
National Mean	556		601		729	

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012; Statistical Abstracts, 2005; 2010; 2012; 2017

The summary statistics in Table 4.3 showed that there was a reduction in the mean enrolment in the Central region across the three-time periods. There was also a reduction in enrolment from Eastern and Nyanza regions between the period 2000 and the period 2004. However, in the other five regions, there was an increasing trend in enrolment levels. At the national level, the mean enrolment increased across the three years, from 556 pupils per school in 2000 to 729 pupils per school in 2012, translating to a 31 percent increase in school enrolment.

The reduction and increase in enrolment per region as noted in Central and other regions could be in line with the study by Bold et al., (2011) study which argued that FPE did not necessarily translate to increased enrolment across all-region in Kenya. The argument was also supported by Republic of Kenya (2008; 2012; 2019) and Vos et al., (2004) who noticed that development in budgetary distribution to essential education couldn't identify with development in enrolment over all regions. This circumstance made a gap in the sum the government would spend to encourage expanding enrolment in schools countrywide.

Several school characteristics including the number of classes, the number of teachers and the number of toilets per school were identified as key variables in the study. The mean and standard deviation presented in Table 4.4.

Table 4.4: Summary Statistics for the Number of Classes, Toilets, and Teachers per School across the Regions

		2000		**2004**		**2012**	
Region Name	Variable	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Central	Total classes	20.33	11.42	16.64	5.31	16.13	5.47
	Total toilets	28.55	24.49	29.16	15.16	22.56	10.99
	Total Teachers	20.82	10.77	18.8	6.17	14.91	4.08
Coast	Total classes	14.14	5.53	16.2	5.97	13.73	5.91
	Total toilets	9.82	6.28	17.55	13.97	11.27	7.91
	Total Teachers	15.89	6.84	17.2	6.87	15.73	6.69
Eastern	Total classes	13.4	5.135	12.04	4.44	12.27	5.74
	Total toilets	12.31	6.03	16.96	9.91	12.41	7.59
	Total Teachers	14.03	7.81	13.56	7.69	12	5.69
Nairobi	Total classes	26.16	8.99	20.9	7.03	27.47	15.57
	Total toilets	25.99	11.21	33.1	11.69	29.27	12.2
	Total Teachers	35.22	19.2	27.35	7.31	38.6	30.8
North Eastern	Total classes	13.73	5.35	16.93	7.78	18	9.6
	Total toilets	8.6	7.06	12.2	8.78	15.67	9.79
	Total Teachers	15.3	7.45	18.87	9.31	15.2	6.5

Table 4.4: Summary Statistics for the Number of Classes, Toilets, and Teachers per School across the Regions (Continued)

Nyanza	Total classes	11.64	5.08	11.16	4.59	13.05	4.98
	Total toilets	7.65	5.29	10.52	5.86	10.85	5.57
	Total Teachers	13.31	9.35	11.56	7.18	12.62	6.68
Rift valley	Total classes	13.92	5.26	13.27	3.59	15	6.35
	Total toilets	13.33	7.86	18.5	12.94	15.71	9.31
	Total Teachers	17.21	8.05	15.53	5.03	15.84	7.14
Western	Total classes	14.3	4.92	14.16	5.48	14.86	6.42
	Total toilets	12.65	8.84	16.24	9.22	16.95	8.45
	Total Teachers	17	8.37	15.28	8.25	16.95	8.45
National Mean	Total classes	15.95	6.46	15.16	5.52	16.31	7.51
	Total toilets	14.86	9.63	19.28	10.94	16.84	8.98
	Total Teachers	18.60	9.73	17.27	7.23	17.73	9.50

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012; Statistical Abstracts, 2002; 2006; 2010; 2014; 2018

The results presented in Table 4.4, indicated that when the FPE implementation was attempted in 2004, the mean number of classes diminished in Central and Eastern areas while in Coast region the mean number of classes dropped somewhere in the range of 2000 and 2004 and later expanded somewhere in the range of 2004 and 2012. Further, the investigation indicated that for Nairobi, Nyanza, Rift valley and Western areas, the mean number of classes expanded hardly. Outstandingly, the mean number of toilets in schools expanded somewhere in the range of 2000 and 2004 and dropped by 2012 in Central, Coast, Eastern, Nairobi, and Rift Valley districts. The outcomes displayed in Table 4.4, it was prominent that, it was uniquely in North Eastern, Nyanza and Western areas the mean number of toilets expanded over the three-timespans.

Examination of the number of teachers in schools likewise uncovered that the normal number of teachers dropped over the three timespans in Central and Eastern districts while Coast and North Eastern areas, the mean expanded somewhere in the range of 2000 and 2004 and dropped somewhere in the range of 2004 and 2012. In any case, Nairobi, Nyanza, Rift valley and Western districts had a turnaround understanding identified by a reduction in the number of toilets available per school. The national mean of the number of classes per school between 2000 and 2004 had minimal reductions but increased significantly in 2012. However, the number of toilets increased significantly in 2004 compared in 2000 but reduced in 2012. The mean number of teachers per school dropped between 2000 to 2004. Further, the increase in the mean number of teachers in 2012, was insignificant. In

addition, Table 4.5 presents the test scores achieved in arithmetic and reading from the SACMEQ results.

Table 4.5: Summary Statistics for SACMEQ Scores in Arithmetic and Reading

Year		**2000**		**2004**		**2012**	
Region	**Variable**	**Mean**	**Std. deviation**	**Mean**	**Std. deviation**	**Mean**	**Standard Deviation**
Central	Arithmetic	557.1	69.95	552.39	55.34	576.43	61.82
	Reading	561.36	74.88	551.53	57.87	575.46	74.69
Coast	Arithmetic	378.59	87.06	562.48	64.15	575.46	74.69
	Reading	557.7	93.73	562.47	65.98	563.53	55.18
Eastern	Arithmetic	539.61	80.14	567.22	60.89	560.35	43.53
	Reading	545.7	87.34	568.92	63.08	543.87	48.68
Nairobi	Arithmetic	628.64	105.49	622.35	55.35	606.59	85.83
	Reading	636.87	113.86	628.75	59.89	624.76	74.57
North Eastern	Arithmetic	523.84	80.88	524.2	46.02	599.11	92.99
	Reading	523.98	92.49	524.14	46.61	558.15	84.67
Nyanza	Arithmetic	507.05	71.28	530.93	52.68	555.18	37.89
	Reading	508.85	80.39	531.32	54.58	542.13	51.92
Rift valley	Arithmetic	562.32	81.87	528.85	70.69	551.74	45.34
	Reading	568.99	90.89	528.89	74.69	532.84	62.92
Western	Arithmetic	523.4	73.32	525.99	46.34	514.04	43.22
	Reading	525.81	81.13	525.97	47.83	494.72	55.61
National Mean	Arithmetic	527.57		551.80		567.36	
	Reading	553.66		552.75		554.43	

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012

The summary statistics presented in Table 4.5 showed that the Nairobi district had the best for both arithmetics and reading scores over the three timeframes. The other high performing locales in year 2000 included Eastern, Rift valley and North-Eastern areas. In the second and third time frames (2004 and 2012 individually), the high performing areas included Eastern, Coast, North Eastern, and Central locales. The national mean for arithmetic expanded by 24 scores somewhere in the range of 2000 and 2004 and further by 16 scores in 2012. Be that as it may, the adjustments in mean scores for reading were unimportant. Further, outline insights the area of different schools in the various areas were presented in Table 4.6.

Table 4.6: Summary Statistics for School Location in 2000, 2004 and 2012

	2000	2004	**2012**
School location	**Number of schools and Percentage**		
Isolated	8(4.6%)	4(2.31%)	3(1.66%)
Rural	90(51.72%)	93(53.76%)	115(63.54%)
Small town	41(23.55%)	33(19.08%)	35(19.34%)
Large city/Urban	35(20.1%)	42(24.28%)	28(15.47%)
Total	**174 (100%)**	**172(100%)**	**181(100%)**

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012

The results provided in Table 4.6, shows that, for the three-timeframes, more than 50 percent of schools tested were situated in rural areas, while more schools that were situated in small towns and big urban areas had a minimal number of schools. These established 33(19.1 percent), 41(23.6 percent) and 35(19.3) and 42(24.3 percent) for small-town separately. The proportion of the number of rural schools in the different areas expanded over the three-timeframes while the number of schools situated located in isolated areas

diminished over the three-year time frame. The summary statistics of distances to social amenities from the different schools are presented in Table 4.7.

Table 4.7: Summary Statistics for School Distances (KM) to Social Amenities, Figures are mean (s.d)

	2000			2004			2012		
Variables	**Mean**	**Std Dev.**	**No. of Obs**	**Mean**	**Std Dev.**	**No. of Obs.**	**Mean**	**Std Dev.**	**No. of Obs**
Clinic	3.74	3.84	174	3.58	3.40	173	3.73	5.06	181
Main road	13.47	35.66	174	16.30	69.69	173	12.86	38.71	181
Library	37.53	45.59	174	41.14	69.37	173	39.03	44.27	181
Bookshop	16.56	33.46	174	11.58	23.15	173	16.27	31.68	181
Secondary school	6.53	14.61	174	6.17	10.32	173	8.60	32.50	181

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004 and 2012

The Table 4.7 indicated that the distance to the nearest library was the highest compared to the distances to other social amenities, in all the three-timespans with a mean and standard deviation of 37.53(45.59), 41.14(69.37) and 39.03(44.27) for 2000, 2004 and 2012 respectively. the distance to the nearest bookshop and road was 16.56(33.46) and 13.47(35.66) respectively in 2000 however 11.58(23.15) and 16.3(69.69) in 2004 and 16.27(31.68) and 12.68(38.71) in 2012 individually. In any case, the distance to the nearest secondary school was at least double to the nearest clinic in the three-time period. The results explained in Table 4.6 and 4.7 were supported by studies carried out by Gibson et al., (2014) and Mizalla and Rumaguerra (2000) that

discussed how school location determined the levels of education quality achieved. The summary statistics for school characteristics that included total enrolment, pupil-class ratio, and pupil-toilet ratio, pupil-book ratio, and pupil-teacher ratio, payment for tuition and school possession index are presented in Table 4.8.

Table 4.8: Summary Statistics for School Characteristics in 2000, 2004 and 2012

Variable	Year	No. of observation	Mean	Standard deviation	Min	Max
Total Enrolment	2000	174	572.07	278.6	87	1355
	2004	173	584.86	327.27	0	1729
	2012	181	900.5	1534.4	88	12582
Class-Pupil ratio	2000	174	36.4	10.4	9.32	67.25
	2004	173	39.11	23.68	15.7	320.67
	2012	181	46.67	18.29	11	138.8
Toilet-Pupil ratio	2000	174	51.7	34.02	12	273
	2004	173	53.11	70.99	5.93	750
	2012	181	62.67	98.48	8	967.8
Book-Pupil ratio	2000	174	0.36	0.72	0	6.06
	2004	173	0.66	1.55	0	10.52
	2012	181	0.77	2.26	0	18.98
Teacher-Pupil ratio	2000	174	32.78	9.67	10.9	72.7
	2004	173	34.22	9.38	13.1	67.43
	2012	181	43.75	15.46	6.28	104.4
Payment for tuition	2000	174	2.26	0.8	1	4
	2004	173	1.63	0.48	1	2
	2012	181	1.92	0.76	1	4
School Possession index	2000	174	7.43	2.09	1	20
	2004	173	7.99	3.48	1	20
	2012	181	7.54	3.09	1	21

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012; Statistical Abstracts, 1998; 2002; 2006; 2010; 2014; 2018

The computation in Table 4.8 showed that total enrolment increased from 572.07 in 2000 to 584.86 in 2004 and further 900.5 in 2012. The changes in enrolment presented a 2.1 percent increasing mean enrolment between 2000 and 2004 and a 35.1 percent increase between 2004 and 2012. The summary statistics further showed that the class-pupil ratio marginally increased from 36.4 to 39.11 between 2000 and 2004 representing a 6.9 percent change

between 2000 and 2004 and a further increase to 46.47 representing a 16.2 percent change somewhere in the range of 2004 and 2012 separately. Student Toilet and student – book proportion expanded hardly somewhere in the range of 2000 and 2004 from 51.7 to 53.11 and 0.36 to 0.66 representing a 2.1 and 6.9 percent expansion individually. In any case, somewhere in the range of 2004 and 2012, the student-toilet and student- book proportion expanded from 53.11 to 62.67 and 0.66 to 0.77 representing 35.1 and 16.2 percent individually. The outcomes likewise demonstrated an expansion in guardians' capacity to pay for education costs for their students somewhere in the range of 2000 and 2004, which diminished somewhere in the range of 2004 and 2012 from 2.26 to 1.63 representing a drop by 5.9 percent. What's more, students who approached a playfield in different schools were exhibited disaggregated by region for the three-year period as shown in Table 4.9.

Table 4.9: Summary Statistics for the Number and Percentage of Schools with Accessible Playfields

Year	2000		2004		2012	
	Number of schools	Percentage	Number of schools	Percentage	Number of schools	Percentage
Central	367	79%	425	95.90%	515	100%
Coast	340	89.90%	297	84.14%	303	87.83%
Eastern	575	96.80%	428	96.40%	452	92.62%
Nairobi	362	100%	372	100%	305	87.40%
North-eastern	261	100%	277	100%	260	79.27%
Nyanza	310	86.60%	393	96.50%	753	100%
Rift valley	445	96.30%	513	96.30%	688	80.20%
Western	299	88.70%	415	91.60%	409	78.20%

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012

The results presented in Table 4.9 indicated that the number of learners from Central, Eastern, Nyanza, and Rift valley had a majority of learners (over 90 percent) for schools with accessible playfields in 2000, 2004 and 2012. Further, the summary statistics for class types disaggregated by the quality of the class; which were either permanent, temporary, or open. These class types were presented in Table 4.10.

Table 4.10: Summary Statistics for the Number of Schools with Different Class Types and Class Numbers

	2000			2004			2012		
	Number of schools with			Number of schools with			Number of schools with		
Number of classes	**Permanent classes**	**Temporary classes**	**Open classes**	**Permanent classes**	**Temporary classes**	**Open classes**	**Permanent classes**	**Temporary classes**	**Open classes**
0	10(5.56%)	108(62.1%)	158(90.8%)	4(2.3%)	115(66.4%)	158(91.3%)	9(4.9%)	111(61.3%)	168(92.8%)
1-10'	71(39.4%)	61(35.1%)	16(9.19%)	60(34.7%)	54(31.2%)	14(8.1%)	69(38.1%)	64(35.3%)	13(7.2%)
11-20'	64(35.6%)	4(2.3%)	0(0%)	77(44.5%)	4(2.3%)	1(0.5%)	76(41.9%)	6(3.3%)	0(0%)
21-30'	22(12.2%)	1(0.6%)	0(0%)	26(15%)	0(0%)	0(0%)	19(10.5%)	0(0%)	0(0%)
0ver 30	7(3.9%)	0	0	6(3.5%)	0	0	8(4.4%)	0	0
Total number of schools	174(100%)	174(100%)	174(100%)	173(100%)	173(100%)	173(100%)	181(100%)	181(100%)	181(100%)

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012;

The summary statistics presented in Table 4.10, showed that most schools had between 1-10 permanent and temporary classes for the years 2000, 2004 and 2012. However, some schools had between 11-20 permanent classes for the years 2000, 2004 and 2012 respectively. The results were in line with Bowers and Urick (2011) and Kim et al., (2016), who noted that class type in a given school was a major determinant of school performance. In addition, the

numbers of teachers in the sampled schools were also analysed on a range of 10 and presented in Table 4.11.

Table 4.11: Summary Statistics for the Number of Teachers in Various Schools and Percentage

No. of Teachers	**2000**	**2004**	**2012**
Number of teachers in a school	Number of Schools		
Less than10	138(79.3%)	24(13.79%)	57(31.5%)
11-20	34(19.5%)	78(44.8%)	83(45.8%)
21-30	2(1.1%)	30(17.2%)	27(14.9%)
over 30	0(0%)	42(24.13%)	14(7.73%)
Total	174 (100%)	173(100%)	181(100%)

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012

The Table 4.11 showed that schools with less than 10 teachers accounted for 79.3 percent in 2000, 13.79 percent in 2004 and 31.5 percent in 2012. Further, schools with teachers between 11-20 accounted for 34 (19.5 percent), 78(44.8 percent) and 83(45.8 percent) in 2000, 2004 and 2012 respectively. In addition, schools with 21-30 teachers were 30(17.2 percent) and 27(14.9percent) in 2004 and 2012 respectively. The results further showed that in 2000 there was no schools with over 30 teachers, however, in 2004 and 2012, 42(24.13 percent) and 14(7.73 percent) of the schools had more than 30 teachers respectively. The number of teachers from the sampled schools was further disaggregated by gender and presented in Table 4.12.

Table 4.12: Summary Statistics for Number of Teachers Disaggregated by Gender

	2000		2004		2012	
Variable	Number of Teachers	Percent	Number of Teachers	Percent	Number of Teachers	Percent
Male Teachers	1,504	48	1,573	49	1,578	49
Female Teachers	1,616	52	1,637	51	1,668	51
Total Teachers	3,120	100%	3,210	100%	3,246	100%

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012

The Table 4.12 showed that the total number of teachers in 2000 was 3,120 with 1,504(48 percent) been male while 1,616 (52 percent) were females. In 2004, the number of teachers increased to 3,210 whereby the number of male teachers was 1,573(49 percent) and that of females was 1,637(51 percent). The number increased to 3,246 in 2012 with the male teachers been 1,578(49 percent) while that of female teachers been 1,668(51 percent). The levels of education for the teachers in the sampled schools are presented in Table 4.13.

Table 4.13: Summary Statistics for Education Level for Teachers per School

	2000		2004		2012	
Level of education	Number of teachers	Percent	Number of teachers	Percent	Number of teachers	Percent
Primary Education	467	14.97	1357	42.27	233	7.17
Secondary Education	2403	77.02	216	6.73	2648	81.58
Tertiary Education	250	8.01	1637	51.00	340	10.49
Total Teachers	3120	100%	3210	100%	3246	100%

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012

Table 4.13 showed that in 2000, the majority of 2,403(77.02percent) had secondary education. In 2004, the number decreased to 2.16(6.7percent) and further increased to 2,648(81.58percent) in 2012. Teachers with tertiary levels of education were highest in 2004 at 1,637(51 percent) while those with primary levels of education were highest in 2004, at 1,357(42.27 percent). In addition, studies by Clotfelter et al., (2011) and Glewwe and Kremer (2006) featured the significance of teacher involvement with the quality of education and by and large school performance. Hence, the teachers' experience was disaggregated by the level of experience and number of teachers as displayed in Table 4.14.

Table 4.14: Number and Percentage of Teachers in Schools with Different Experience

Teacher Characteristics		2000	2004	2012
Teacher Experience	**No. of teachers in a School**	**Number of schools and Percentage**	**Number of schools and Percentage**	**Number of schools and Percentage**
Teachers with NO experience	0	138(79.31%	143(82.6%)	116(63.7%)
	1-10'	34(19.5%)	30(17.4%)	64(35.2%)
	11-20'	2(1.14%)	0(0%)	2(1.09%)
	over 20	0(0%)	0(0%)	0(0%)
Teachers with Less than one year of experience	0	158(90.8%)	168(97.1%)	156(86.2%)
	1-10'	16(9.2%)	5(2.9%)	24(13.3%)
	11-20'	0(0%)	0(0%)	1(0.5%)
	over 20	0(0%)	0(0%)	0(0%)
Teachers with one year of experience	0	161(92.53%)	170(98.3%)	169(93.4%)
	1-10'	12(6.9%)	3(1.7%)	11(6.07%)
	11-20'	1(0.57%)	0(0%)	1(0.5%)
	over 20	0(0%)	0(0%)	0(0%)
Teachers with 1-2 years of experience	0	1(0.57%)	3(1.7%)	4(2.2%)
	1-10'	57(52.8%)	48(27.7%)	81(44.8%)
	11-20'	69(39.7%)	82(47.4%)	66(36.5%)
	over 20	47(27.01%)	40(23.1%)	30(16.6%)
Teachers with 2-3 years of experience	0	138(79.3%)	146(84.4%)	141(77.5%)
	1-10'	35(20.1%)	26(15.02%)	37(20.3%)
	11-20'	0(0%)	1(0.5%)	2(1.09%)
	over 20	1(0.5%)	0(0%)	2(1.09%)
Teachers with over 3 years of experience	0	162(93.1%)	1(0.8%)	149(82.3%)
	1-10'	11(6.3%)	42(32.6%)	30(16.6%)
	11-20'	1(0.5%)	86(66.7%)	2(1.1%)
	over 20	0(0%)	0(0%)	0(0%)

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2008; 2012

Teacher experience levels explained in Table 4.14 showed that the majority 34(19.5 percent) of schools in 2000 had 1-10 teachers with no teaching experience. In addition, 30 (17.4 percent) and 64 (35.2 percent) of schools in

2004 and 2012 respectively had 1-10 teachers. For teachers with 2-3 years of experience, the analysis revealed that 35 (20.1 percent) of schools in 2000; while 26 (15.02 percent) of schools in 2004 and 37 (20.3 percent) in 2012 had 1-10 teachers respectively. The results further indicated that teachers with at least 3 years of experience were from 16.8 (10.5percent) of schools with a majority of teachers numbering 1-10 in 2000, 16.0 (8.3 percent) and 14.8 (16.0 percent) in 2000, 2004 and 2012 respectively. In addition, the summary statistics found that teachers with over 10 years of experience were in only 11 (6.3 percent) of schools in 2000, 42 (32.6percent) and 30 (16.6percent) in 2004 and 2012 respectively. This cadre of teachers recorded the highest staffing levels in this cadre of experience.

4.3 Diagnostic Tests Results

4.3.1 Results for Diagnostic results for Heteroscedasticity

The Breusch-pagan and Cook-Weisberg test was used to determine levels of heteroscedasticity and the results are presented in Table 4.15.

Table 4.15: Tests for Data Heteroscedasticity Using the Breusch-Pagan and Cook-Weissberg Test

Depended variables	Enrolment	Arithmetic Scores	Reading Scores
chi	0.08	3.37	1.01
Prob>chi	0.782	0.665	0.315

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012

The results presented in Table 4.15, showed that *chi* and the *prob>chi* which determined the non-existence of heteroscedasticity. Thus, the P-value of the chi-square for enrolment, arithmetic, and reading scores was more than 0.05, hence the error terms of the three models were homoscedastic hence the null

hypothesis was not rejected. This notwithstanding, the Generalized Least Squares Model (GLS) was used in the analysis.

4.3.2 Results for Diagnostic Tests for Multicollinearity

The results for the Variance Inflation Factor (VIF)3 test were presented in Table A1. The results indicated a mean VIF of 1.655 and 1/VIF of 0.41, hence, multicollinearity was not a problem. A variance inflation factor (VIF) for all the independent variables more than 10 (VIF >10) would indicate a problem of multicollinearity (Kutner, Nachtsheim & Neter, 2004).

4.3.3: Results for Diagnostic tests for Fixed Effects and Random Effects for the Pseudo –Panel Analysis

The Haussmann test on the *xtreg* fixed and random effect models (see Table A2), Prob>chi2 = 0.045 and chi2 (16) = (b-B)'[(V_b-V_B) ^ (-1)] (b-B) = 2.14e-20 was achieved. Given that 0.045<0.05, then, the unique errors (ui) were uncorrelated with the regressors, and therefore the null hypothesis was rejected, thus, the regression analysis adopted fixed-effect analysis for objectives one and two (Greene, 2010; Williams, 2015).

4.4. Effect of Government Expenditure on Enrolment

The regression analysis presented in this section discussed the empirical findings analysing the effect of government expenditure on enrolment. These results answer objective one of this study as were undertaken using pseudo-panel analysis which allowed for fixed effects as expressed in equation 3.43.

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[3] **VIF** measure how much the variance of the estimated regression coefficients are inflated as compared to when the predictor variables are not linearly related. It is used to explain how much amount multicollinearity (correlation between predictors) exists in a regression analysis

The results presented in Table A2 and Table A3 provided justification for the adoption of a fixed-effect model.

The regression results of the analysis to determine the effect of government expenditure on enrolment presented in Table 4.16, were based on pseudo-panel data for periods 2000, 2004 and 2012. In this analysis, enrolment was the dependent variable.

Table 4.6: Regression for Government Expenditure on Enrolment

Multi-variate Regression Analysis			
Variables	**2000**	**2004**	**2012**
Government Expenditure	0.757***(0.147)	1.000***(9.12e-06)	1.000***(1.83e-07)
School Infrastructural Characteristics			
Total Teachers	0.051***(0.04)	0.053***(0.004)	0.012***(0.002)
Total classes	1.019***(0.06)	1.137***(0.06)	1.134***(0.07)
Availability of playfield	0.445*(0.25)	-0.559**(0.23)	0(0)
Total toilets	0.426***(0.09)	0.338***(0.09)	0.622***(0.16)
Total books	0.035(0.0465)	-0.019**(0.0354)	0.178*(0.0913)
School Location			
Isolated	0(0)	0(0)	0(0)
Rural area	2.26***(0.076)	2.257***(0.076)	0(0)
Small town	1.67***(0.099)	0(0)	0(0)
Large city/town	-0.074(0.049)	-0.049(0.053)	-0.047(0.056)
School Distance to Social Amenities			
school distance to clinic	-0.13***(0.035)	0.004761(0.065)	-0.061(0.066)
School distance to road	0.017(0.04)	0.011(0.035)	-0.13***(0.04)
School distance to library	-0.083**(0.035)	0.00415(0.024)	-0.002(0.05)
School distance to bookshop	0.004(0.04)	-0.087**(0.04)	0.06*(0.035)
School distance to secondary school	1.209***(0.353)	-0.131(0.082)	-0.127(0.158)
Class Types			
Permanent classes	1.168***(0.0818)	0.608**(0.212)	0.704***(0.0916)
Temporary classes	-0.0304(0.0749)	0.281(0.383)	0.612***(0.0506)
Open classes	0.289*(0.08)	-0.117(0.183)	-0.196***(0.038)
R squared	0.6424	0.321	0.258

*** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses

Source: Authors Computation Based on SACMEQ Survey data; 2000; 2004; 2012

Table 4.16 indicated that in the year 2000, an expansion in government expenditure by one million shillings would increase enrolment in the nation by 757,000. Likewise, an increase in government expenditure by one million

shillings would increase enrolment in the nation by one million pupils in 2004 and furthermore by one million students in 2012 separately. The distinctions distinguished over the panel data in the three-timeframes were 51.3 percent in 2000, which decreased to 24.1 percent and hardly expanded to 27.3 percent in 2004 and 2012 individually (see Table A4). The outcomes were practically identical with Bold et al., (2011) and Tinker, Iscan, and Rosenblum (2013) who noticed that government financing to education positively affected enrolment. Further, as per Mizalla and Rumaguera (2000), the examination recognized that motivators in the education part were an inspiration for expanded enrolment, consequently the requirement for expanded government uses. The government expenditure in different schools was used for the obtaining of various data sources, for example, school foundations. These frameworks incorporated the classes, toilets, course readings, and the existent of playfields.

The investigation further indicated that an expansion in the number of teachers in the nation by 1000, would bring about an increment enrolment by 51 pupils in every state-funded school in the nation in the year 2000. In the event that the number of classes in the nation expanded by 10, enrolment would increment by 10 for every school in 2000, further expanding to 11 understudies in 2004 and 11 students for every school in 2012 separately. Furthermore, an expansion in the number of playfields by 100 in the nation would bring about an expansion in enrolment by 45 understudies for each school in 2000, notwithstanding, the enrolment would diminish by 56 students for every school in 2004 individually, with no adjustment in enrolment in 2012. What's more, the development of 100 new toilets for every school in the

nation would expand levels of enrolment in a school by 42, 33 and 62 understudies for each school in 2000, 2004 and 2012 separately.

The outcomes additionally demonstrated that the coefficients for the number of classes, the number of teachers and complete toilets were sure and measurably critical 1 percent level. What's more, coefficients for the number of books and accessibility of playfield were negative and measurably noteworthy at 5 percent levels in 2004. In the years 2004 and 2012, coefficients for the accessibility of books were certain as well as being statistically significant at a 1 percent level.

The results further noted that coefficients for the number of toilets were positive for the three-time periods. In 2004 and 2012, the coefficients for the number of toilets were positive and also statistically significant at 1 percent level. These results were comparable to Musalia (2005) and Bold et al. (2011) who found that it was generally impossible to implement the FPE programme because the allocations made to schools were inadequate and coupled with delayed disbursement thus hampering the effective implementation of the programme especially in the procurement of basic infrastructures. However, the results did not agree with Foley, (2003); Dutt, (2011), and Tandi, (2013), who argued that in relation to school resources, school enrolment was not depended on the inputs accrued from government expenditure. This relationship was depended on the social-economic status of households and school choice (Keller, 2006; Zoran, 2015; Mallick et al., 2016). Using the

pseudo-panel regression, the fixed effect for interclass correlations[4] in 2000 was 41.2 percent which increased to 56.3 percent in 2004 and reduced to 43.2 percent in 2012.

School location was explained by whether a school was in an isolated area, a rural area, a small town or a large town or city. The coefficients for the variables explaining school locations were positive for the three-time period. In addition, coefficients for large cities and towns were positive and statistically significant at 1 percent. Notably, an increase in the number of schools located in rural areas in the country by 10, would increase enrolment levels by 22 pupils per school in 2000 and 2004 respectively. In addition, an increase in the number of schools located in small-town in the country by 10 would increase enrolment by 16 pupils per school in 2000. The results discussed were in line with Bold et al., (2011) and Viscusi and Gayer, (2015) who found that school location affected enrolment, school transfers, class size and cost per pupil in the school.

Another variable used was the distance of school to social amenities consisting of main road, clinic, library, bookshop or secondary school. In 2004, only coefficients for distance to social amenities, distance to bookshop were statistically significant at 5 percent and also negative. In 2012, coefficients for distance from school to the nearest road and the nearest bookshop were negative and statistically significant at 1 percent and 10 percent respectively.

[4] **Interclass correlation** (or *interclass correlation coefficient*) measures a bivariate relation among variables. The Pearson correlation coefficient is the most commonly used interclass correlation.

These results were similar to Afonso and Jalles (2013) and Flavin et al., (2014) who identified the existence of differences between urban and rural schools in size, cost of education, size of staff and access to curricular and extra-curricular activities. Further, the existence of social amenities was facilitated by the extent of economic development and development of new infrastructure such as roads (Musila & Belassi, 2004; Woessmann, 2007; Mallick & Dash, 2015).

In addition, studies by Hanushek and Woesmann (2013) and UNESCO (2010) argued that class types were a key determinant for different levels of enrolment in a school irrespective of the source of expenditure (See also Bowers & Urick, 2011; Zoran, 2015; Soydan & Bedir, 2015). The types of classes in school were categorized as permanent, temporary or open classes. The coefficients for permanent classes were positive and statistically significant at 1 percent level in 2000 and 2012. However, the level of statistical significance was 5 percent in 2004. In addition, in 2012, the coefficients for temporary classes were negative and statistically significant at 1 percent level in 2004. Further, the results showed that coefficients for the number of open classes were positive and statistically significant at 10 percent in 2004 and 1 percent in 2012 respectively.

The results also indicated that construction of 100 permanent classes in the country would increase enrolment per school by 117 pupils per school in 2000, 60 in 2004 and 70 in 2012 respectively. In addition, an increase in temporary classes by 100 in the country would reduce enrolment by 3 pupils per school given that parents would wish to enroll their children in schools

with permanent classes. In 2004 and 2012, an increase in temporary classes by 100 classes would increase enrolment by 60 and 28 pupils per school respectively. However, an increase in open classes by 100 in the country would increase enrolment by 29 pupils per school in 2000; but an increase of 100 open classes in 2004 and 2012 would reduce enrolment per school by 12 and 20 pupils per school respectively. In addition, the analysis revealed that the interclass correlations among variables in 2000 were 50.5 percent but reduced to 31.2 and 26.8 percent in 2004 and 2012 respectively. Further, the coefficients for the number of classes and school possessions were negative.

The results discussed in this section were similar to the studies by Bold et al., (2011) and Mizalla and Rumaguera (2000) and Tinker et al., (2013), Foley (2003); Musalia (2005); Bold et al., (2011); Dutt (2011); Tandi, (2013); Viscusi and Gayer (2015) who noted the number of classrooms, the number of textbooks and number of teachers in a school determines the levels of school enrolment.

4.5 Effect of Government Expenditure on Quality of Education

The results for the regression were presented in Table 4.17.

Table 4.17: Effect of Government Expenditure on Quality of Education

Regression Analysis						
Variables	Arithmetic score 2000	Arithmetic score 2004	Arithmetic score 2012	reading score 2000	reading Score 2004	reading Score 2012
Government Expenditure	12.53*** (7.00)	51.69*** (10.52)	48.49*** (14.12)	94.41*** (11.19)	63.8*** (12.11)	73.7*** (15.31)
School characteristics						
Pupil-Book ratio	0.0337** (0.0138)	0.0037 (0.005)	0.0068** (0.003)	0.0349** (0.001)	0.00747 (0.006)	0.007** (0.004)
Pupil-Toilet ratio	-0.479*** (0.155)	-0.102* (0.054)	-0.023 (0.065)	-0.001*** (0.0003)	-5.07** (2.99)	-0.15*** (0.072)
Availability of playfield	0.0968 (0.0911)	-0.14** (0.061)	0(0)	0.11 (0.092)	-0.15*** (0.06)	0 (0)
Class-pupil ratio	2.03*** (2.379)	0.0004 (0.003)	0.00098 (0.007)	4.76*** (0.001)	0.001** (0.004)	0.00065 (0.0008)
Permanent classes	0.285 (2.741)	-2.13 (1.45)	1.768* (0.923)	0.417 (0.03)	-0.201** (0.094)	0.019*** (0.521)
Temporary classes	0.611 (2.937)	-2.874 (1.891)	1.216 (1.539)	0.77 (3.215)	-0.0492 (0.1230	-0.0137 (0.678)
Open classes	-2.192 (4.705)	-5.652** (2.551)	1.817 (3.131)	-3.005 (5.15)	-0.289* (0.167)	0.0395* (0.234)
Distance to clinic	-0.0146 (0.012)	-0.0196** (0.00969)	-0.021** (0.0082)	-0.0152 (0.013)	-0.03*** (0.011)	-0.02** (0.01)
Distance to road	-0.022*** (0.008)	-0.00789 (0.00701)	-0.00079 (0.0089)	-0.024*** (0.008)	-0.019** (0.007)	-0.011 (0.010)
Distance to library	0.0125 (0.009)	-0.00836 (0.00623)	-0.0118* (0.0067)	0.013 (0.00982)	-0.0093 (0.007)	-0.014* (0.0081)
Distance to bookshop	-0.0223** (0.009)	-0.00912 (0.00785)	-0.00629 (0.0068)	-0.0231** (0.010)	-0.02*** (0.008)	-0.0095 (0.008)

Table 4.17: Effect of Government Expenditure on Quality of Education (Continued)						
Distance to secondary School	0.0260*** (0.009)	0.0129 (0.0079)	-0.00314 (0.0058)	0.0276*** (0.010)	0.025*** (0.009)	-0.0036 (0.008)
Total school possession	0.257*** (1.565)	3.768** (1.871)	0.28*** (1.856)	0.206*** (1.687)	4.670** (1.838)	1.238*** (1.973)
Isolated	0.3937*** (61.58)	0.20 (58.08)	0.197 (34.61)	0.4062*** (67.4)	0.2957 (3.78)	0.0768*** (3.12)
Rural area	0.3684*** (58.19)	0.2454 (52.42)	0.4347 (33.03)	0.3806*** (63.69)	0.4099 (3.41)	0.1164*** (4.601)
Small town	0.384*** (59.77)	0.3621 (52.83)	0.1962 (34.29)	0.3971*** (65.42)	0.4698 (3.45)	0.796* (4.234)
Large city /town	0.4204*** (64.02)	0.4128 (54.28)	0.6261* (36.18)	0.4359*** (70.07)	0.599*(3.55)	0.9807*** (12.18)

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012; *** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses

The results in Table 4.17 indicate that coefficients for government expenditure were positive and statistically significant at one percent level in the three-year period for both arithmetic score and reading score. Notably, an increase in government allocation by one million in 2000, 2004 and 2012 would increase the arithmetic scores by 12.53, 51.69 and 48.49 respectively. In addition, an increase in government allocation by one million in 2000, 2004 and 2012 would increase reading scores by 94.4, 63.8 and 73.7, respectively.

The results further indicated that the coefficients for pupil-book ratio and pupil-class ratio were positive. In addition, coefficients for pupil-book ratio were statistically significant at a 5 percent level in 2000 and 2012 for both arithmetic and reading scores while the coefficients for toilet-pupil ratio were negative for quality of education. In 2000 and 2004, coefficients for pupil-toilet ratio were also found to be statistically significant for arithmetic scores while reading scores were statistically significant in the three-time period. The results further showed that an increase in the pupil-book ratio by 100 in the country would increase arithmetic scores by 3.37 per school in 2000, while the same increase in 2004 and 2012 would increase the arithmetic scores by 3.7 and 6.8 per school respectively.

A similar increase in the pupil-book ratio by 100 in the country in each of the periods; 2000, 2004 and 2012 would increase reading scores by 34.9, 7.4 and 7 per school respectively. However, reduction in the toilet-pupil ratio by 10 from the current mean of over 50 in the country in 2000, 2004 and 2012, would reduce the mean arithmetic scores by 47.9, 10.2 and 2.3 per school

respectively. Further, an increase in the pupil-class ratio by 10 in the country would reduce the mean score for arithmetic per school by 20.3 per school and mean reading score by 47.6 per school in 2000. The changes in pupil-class ratio would have no minimal change in both reading and arithmetic scores in 2004 and 2012 respectively.

In addition, coefficients for the availability of playfield were positive in 2000 for both arithmetic and reading scores but negative for both arithmetic and reading scores in 2004 but positive in 2012. The results also indicated that an increase in the number of playfields in the country by 100 would result in an increase in the mean scores per school for both arithmetics and reading in 2000 by 9.68 and 11 respectively. In addition, an increase in the number of playfields by 100 in the country in 2004, would reduce arithmetic mean scores by 14 and reading scores by 11 respectively. Further, in 2012, an increase in the number of playfields in the country would have no effect on the mean scores for arithmetic and reading. The results presented were in line with Carnoy et al., (2001) who noted that school resources and school characteristics majorly contributed to student learning as evidenced in 2000 before the introduction of FPE.

In the analysis, class types were explained as either permanent, temporary or open. The analysis showed that, in 2000 and 2012, coefficients for permanent and temporary classes were positive for both arithmetics and reading scores in 2000 and 2012 but negative in 2004 respectively. Further, the coefficients for open classes were negative and statistically insignificant in 2000 and 2004 for

both arithmetic and reading scores respectively. In addition, the coefficients for open classes were positive for both arithmetic and reading scores in 2012.

Notably, an increase in permanent classes by 100 in the country in 2000 would result in an increase in arithmetic and reading scores per school by 28.5 and 41.7 respectively. In addition, an increase in the number of temporary classes in the country by 100 in 2004 would reduce mean scores for arithmetic and reading by 213 and 20.1 per school respectively. Further, in 2012, an increase in permanent classes by 100 in the country would increase both arithmetic and reading per school by 176.8 and 1.9 respectively. The results were in line with studies undertaken by Santín and Sicilia, (2014) and Cordero-Ferrera, et al., (2015), who found that regardless of class type, temporary and permanent classes were statistically significant with quality of education.

The results further showed that the coefficients for school locations were positive for both arithmetic and reading mean scores in 2000. This was also evident for schools in rural, small and large towns, whose coefficients were positive for arithmetic and reading scores, and statistically significant at 1 percent in 2000 respectively. The coefficients for schools located in rural areas and large towns were also statistically significant at 1 percent for reading scores respectively.

The results also showed that an increase in the number of schools located in isolated regions in the country by 100 in 2000, would increase mean scores for arithmetic and reading by 39.4 and 40.6 respectively. Also, an increase in the number of schools located in rural areas in the country by 100 would also increase mean scores for arithmetic and reading by 36.8 and 38.1 respectively;

while an increase in the number of schools located in small towns 100 in the country by would increase mean scores by 38.4 and 39.7 respectively. Notably, an increase in the number of schools located in large cities/towns in the country by 100 would have the highest increase in mean scores for reading and arithmetic by 42.04 and 43.6 respectively. Further, an increase in the number schools located in isolated, rural, small and large towns by 100 in each location countrywide would increase mean scores for reading by 76.8 per school for the schools located in rural areas, 116.4 per school located in urban area, 79.6 per school located small town and 98.1 per school located in large city/town.

These results from the analysis were supported by studies undertaken by Musyoka (2003) and Gibson et al., (2014) who noted that no school set of infrastructure could claim superior performance, though some studies reported the opposite which had not been justified in this study. The results also showed that government budgetary allocation to schools was used to accumulate various education inputs that resulted in overall school possession.

The results further showed that coefficients for school possession index were positive and statistically significant at 1 percent in 2000 and 2012 and at 5 percent in 2004 for arithmetic and reading scores respectively. The results also showed that an increase in the school possession index by 100 in the country in 2000, would increase mean scores for arithmetic and reading by 25.7 and 20.6 per school respectively. In 2004, an increase in the school possession index by 100 in the country would increase arithmetic and reading means scores by 37.7 and 46.7 per school respectively.

Further, an increase in the school possession index by 100 in the country would increase arithmetic and reading scores by 28.4 and 12.4 per school respectively. The analysis was in line with a study by Tow (2006) argued that the shock on enrolment in 2004 marginally affected the quality of education.

Although government expenditure was not directly used for teacher remuneration, the analysis adopted teacher characteristics which included the number of teachers, pupil-teacher ratio, teacher experience, and qualifications affect the quality of education. In this regard, the effect of government expenditure and quality of education given teacher characteristics was presented in Table 4.18.

Table 4.18: Effect of Government Expenditure and Quality of Education (continued)

Panel Regression Analysis						
Variables	Arithmetic score 2000	Arithmetic score 2004	Arithmetic score 2012	reading score 2000	reading Score 2004	reading Score 2012
Teacher Numbers and Teacher-pupil Ratio						
Total Teachers	-19.6*** (3.57)	1.73*** (0.509)	0.835 (0.625)	-22.6*** (3.92)	8.53*** (15.36)	1.297 (1.067)
Pupil-Teacher ratio	1.225** (0.513)	-1.74*** (0.181)	-1.02*** (0.269)	1.12** (0.545)	-1.79*** (0.449)	-1.32*** (0.312)
Teacher Experience						
No experience	24.0*** (3.827)	-5.84 (51.95)	0.324 (0.761)	27.3*** (4.197)	-74.2***(15.44)	1.375 (1.15)
Less than 1 year	11.72** (4.825)	-5.206 (52.63)	1.23 (0.888)	16.3***(5.29)	-87.9*** (15.99)	3.88*** (1.302)
At least 1 year	2.14*** (3.529)	-6.98 (53.3)	-3.92*** (1.304)	1.15***(1.3)	-98.0*** (16.39)	-2.88*** (1.074)
At least 2 years	1.89*** (0.155)	-0.0174 (51.59)	4.329** (0.662)	2.3*** (4.037)	-81.2*** (15.35)	2.298** (1.078)
At least 3 years	7.19*** (0.761)	-5.184 (51.63)	1.738*** (0.578)	2.8*** (4.163)	-86.1*** (15.28)	1.213 (1.355)
More than 3 years	21.5*** (2.849)	16.85 (54.36)	1.929* (0.988)	42.9***(7.06)	-82.1*** (17.85)	3.941*** (1.31)
Teacher Qualification						
Teacher with primary education	13.7*** (51.48)	34.13 (55.67)	-7.21***(2.54)	15.7*** (55.45)	77.43 (51.6)	-6.6*** (3.02)
Teacher with secondary education	13.74*** (51.46)	39.19 (55.46)	0 (0)	15.74***(55.43)	81.56 (51.4)	-0.005 (3.59)
Teacher with Tertiary education	13.57*** (51.49)	39.48 (55.42)	8.190*** (3.011)	15.57*** (55.44)	81.7 (51.4)	0 (0)

*** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012

The results presented in Table 4.18 showed that the coefficients for the number of teachers were negative and statistically significant at 1 percent levels for both arithmetic and reading in 2000 respectively Moreover, an increase by 10 teachers in the country in 2000 would increase arithmetic and reading scores by a mean of 196.4 and 226 for each school respectively. Further, an increase in the number of teachers by 10 in the country in 2004

would increase arithmetic and reading scores by 17.34 and 85.34 per school respectively.

The coefficients for pupil-teacher proportion were positive and statistically significant at 5 percent in 2000 on both reading and arithmetic mean scores. Further coefficients for student-teacher proportions were positive and statistically significant at 1 percent for both arithmetic and reading scores individually in the years 2000, 2004 and 2012. In the year 2012, coefficients for teacher-student proportions were negative and statistically significant at 2 percent for both reading and arithmetic scores respectively. Furthermore, in 2004 and 2012, the coefficients for teacher-student ratio were negative and statistically significant at 1 percent levels for both arithmetic and reading mean scores respectively.

The outcomes showed that a decrease in the student-teacher for proportion by 10 in the nation in 2000 would increase the mean scores for arithmetic and reading by 12.15 and 11.2 per school respectively. A further decrease of the pupil-teacher ratios in the nation by 10 out of 2004 would result to a decrease of the mean scores for both arithmetic and reading by 17.4 and 17.9 per school while a decrease in pupil-teacher proportion in the nation by 10 out of 2012 would likewise result to a decrease in the mean scores for both arithmetic and reading by 10.2 and 13.2 scores per school respectively. These outcomes on overall teacher numbers and pupil-teacher proportion concurred with studies by De Witte and Lopez-Torres, (2015); Sotiriadis, (2016) and Johnes et al., (2017) who noticed that teacher numbers and simultaneous pupil-teacher

proportion could have had a critical association with pupil accomplishment particularly in arithmetic scores. The relationship was additionally constrained to the environment within which pupil-class and pupil-teacher ratios were managed.

Furthermore, the coefficients for instructors with one-year experience were certain and measurably huge at 1 percent level in 2000 however negative in 2004 and 2012 for both perusing and number-crunching mean scores separately however factually huge at 1 percent level in 2012. The outcomes likewise indicated that expansion by 10 instructors with one year's involvement with the nation would expand mean scores for number-crunching and perusing by 21.4 and 11.5 per school in 2000 individually. Further, an expansion by 10 instructors with one year's involvement with the nation in 2004 and 2012 would bring about a decrease in the mean scores for number juggling and peruse by 69.8 and 980 and 39.2 and 28.8 per school in 2004 and 2012 individually.

Remarkably, the coefficients for instructors with at any rate two years of showing experience were sure for number juggling and perusing mean scores in 2000 and 2012, with 1 percent and 5 percent factual criticalness levels individually. The outcomes likewise demonstrated that an expansion in the number of teachers with at least two years' teaching in the country by 10 instructors in 2000 would bring about an increment in the mean scores for number juggling and perusing by 18.8 and 22.8 per school separately. Likewise, an expansion by 10 instructors with at any rate two years'

involvement with 2012 in the nation would prompt an expansion of the mean scores for math and read by 43.29 and 22.98 per school individually. The coefficients for instructors with at any rate three years' experience were certain for number juggling and perusing mean scores which were factually huge at 1 percent in 2000 and 2012. The outcomes exhibited in Table 4.18 further indicated that an expansion in the number of teachers with at least three years of teaching by 10 in the country in the year 2000 would bring about an increment in the mean scores for arithmetic and reading by 71.99 and 28.1 per school individually. Further, an expansion in the number of teachers by 10 with at any least three years of involvement with the nation in 2012 would build arithmetic and reading mean scores by 17.38 and 12.13 per school separately.

In any case, in 2004, the examiner indicated that an expansion in the number of teachers with at least three years of experience by 10 would prompt decrease of arithmetic and reading scores by 51.84 and 28.1 per school individually. This event would have been expected to expand in enrolment experienced in 2003 after the usage of the Free Primary Education. The outcomes examined in this area were in accordance with contemplates did by Clotfelter et al. (2011) and Glewwe and Kremer (2006) who found that inexperienced teachers were less powerful with little information on the degree of viability embraced in various kinds of readiness.

In the relapse examination, teachers' capabilities were clarified by the number of years that teachers had been giving teaching within given school conditions

was introduced. The outcomes found that the coefficients for teachers with minimum qualifications with essential training capabilities were certain for both arithmetic and reading mean scores in 2000 and 2004 however negative in 2012 separately. The outcomes further demonstrated that the coefficients were measurably huge at 1 percent level in 2000 and 2012 for both arithmetic and reading mean scores individually. The outcomes likewise uncovered that an expansion in the number of teachers with certificate in education by 10 educators' in the nation in 2000 would build the mean number-crunching and perusing scores by 137 and 156.6 per school while a similar increment in 2004 would expand the mean scores for math and perusing by 34.4 and 77.4 per school separately. Further, an increase in the number of teachers with diploma in teaching in the country by 10 teachers would lessen the mean scores for arithmetic and reading by 72.0 and 66 for every school respectively.

The coefficients for teachers with a diploma of education were certain for arithmetic and reading implies scores in 2000 and 2004. Further, the coefficients for educators with secondary school qualification in education were statistically significant at 1 percent level in 2000. Outstandingly, an expansion in the number of teachers with secondary qualifications in education in the country by 10 in the year 2000 would prompt an increase in the mean scores arithmetic and reading by 137.4 and 157.4 per school respectively.

Also, coefficients for teachers with a tertiary degree of training were positive and statistically significant at 1 percent in 2000 and 2012. The investigation

likewise featured that an increase in the number of teachers with tertiary degree of training in the country by 10 in 2000 would prompt an increase in the mean scores for arithmetic and reading by 135.7 and 155.7 per school respectively. Additionally, an increase in the number of teachers with tertiary degree of education in the country by 10 in the year 2012, would bring about an increment in the mean scores for arithmetic by 81.9 yet 0 for reading around the same time; in this way, implying no adjustment in scores for reading. These outcomes talking about teacher capability and experience were in accordance with past investigations that found that the teachers' degree of training and experience decided the degree of the school's quality of education (Lee, Zuze, and Ross, 2005; Michaelowa &Witmann, 2012; Hashunek and Woessmann, 2016).

4.6 Contribution of Government Expenditure to School Technical Efficiency

This section introduced observational discoveries for technical efficiency estimation and their determinants. The outcomes from this area addressed objective three of this study.

The blend of viable services with the least school assets and on such a provided overall or Total Economic Efficiency (TEE) of a school. The Total Economic Efficiency comprised of Technical Efficiency (TE) and Allocative Efficiency (AE). As sketched out in the literature, efficiency analysis showed positive changes in inputs which didn't bring about a corresponding change in outputs. This was usually known as the Variable Returns to Scale Technical Efficiency (VRSTE). Furthermore, when efficiency expected that all units

were working at an ideal scale, that is., if while changing all inputs by a positive corresponding element, the impact was expanding outputs by a similar factor, at that point the structure was alluded to as Constant Returns to Scale Technical Efficiency-(CRSTE).

The VRSTE, the CRSTE, and the scale efficiency results were examined from the schools' inputs and outputs clarified in Table 3.3 and displayed in Table A6. The outcomes introduced were in the percentage of schools with varying degrees of efficiency in Kenya's 8 regions. Moreover, the outcomes indicated that general CRSTE was lower contrasted with VRSTE where changes from inputs to outputs greatly affected school productivity. In both CRSTE and VRSTE, the efficiency levels dropped between 2000 and 2004 yet later improved between 2004 and 2012 for most schools.

In 2000, schools in North Eastern and Western regions had CRSTE and VRSTE levels of under 70 percent and 90 percent respectively. Further, schools in regions like Coast, Nairobi, and Rift valley had high-efficiency levels of 88 percent, 87 percent, and 95 percent respectively. Under CRSTE, between 2000 and 2004, schools in the Western and Nairobi region expanded their mean efficiency levels, while under VRSTE there was an expansion in mean efficiency levels for schools in North Eastern, Coast, and Western regions. There was, be that as it may, no adjustment in efficiency levels for schools in the Eastern district under CRSTE and Central and Nairobi regions under VRSTE in 2000 respectively. In 2012, the CRSTE for schools in the Western region had a marginal drop of 1 percent while VRSTE for schools in

the North-Eastern, Coast, Nairobi, and Western diminished in efficiency levels. For both CRSTE and VRSTE schools in every other region had an expansion in efficiency scores. In 2000, aside from schools in Nairobi and Rift valley regions, every single other region had between 5-33 percent of their schools with efficiency levels below 50 percent. The pattern in school efficiency dropped in 2004 however improved in 2012 with most of schools having efficiency levels of between 51-99 percent.

These outcomes were on the side of studies attempted by Carnoy et al., (2001); Cordero-Ferrera et al., (2015); Baqaee et al., (2017b), and Johnes et al., (2017) who noticed that school attributes, teacher experience, and government expenditure were key determinants for school efficiency The investigation further noticed that school efficiency was dictated by the number of inputs utilized in the model while the normal outputs were figured to give input and output change which displayed either CRS, IRS or CRS as delineated in Kwabena and Appah (2004) and De Witte& López-Torres (2015).

4.6.1 Input and Output Target Change in Technical Efficiency

The DEA results given in Table 4.19 sketched out the input, output, and technical efficiency change levels that were analyzed to decide levels of input and output change across schools in the different areas. The input and output targets enabled schools to be technically efficient by utilizing the necessary number of inputs and delivering a targeted number of outputs. Outstandingly, levels of technical efficiency change in outputs and inputs were clarified by schools displaying Decreasing Returns to Scale (DRS), Increasing Returns to

Scale (IRS) and additionally Constant Returns to Scale (CRS).A cumulative analysis of input and output targets was been carried out and presented in Table 4.19:

Table 4.19: Technical efficiency Change, Output, and Input change levels

	Efficiency levels at region levels					Output change		Input change				
Region Name	Year	CRSTE	VRSTE	SCALE	Levels of scale	Arithmetic average score change	Reading average score change	Total enrolment change	government expenditure change	Toilets change	total classes change	total teachers change
Central	2000	0.790	1.000	0.790	Drs	-	-		-	-	-	-
	2004	0.746	0.981	0.760	Drs	11.102	36.797	-0.892	-	-6.518	-1.083	-0.787
	2012	0.900	1.000	0.900	Drs	-	-	-	-	-	-	-
Coast	2000	1.000	1.000	1.000	-	-	-	-	-	-	-	-
	2004	0.828	0.978	0.846	drs	16.500	12.800	-75.5	-97,273.3	-	-2.1	-0.7
	2012	1.000	1.000	1.000	-	-	-	-	-	-	-	-
Eastern	2000	0.793	0.997	0.795	drs	1.727	1.742	-5.46	-	-0.375	-	-1.932
	2004	1.000	1.000	1.000	-	-	-	-	-	-	-	-
	2012	1.000	1.000	1.000	-	-	-	-	-	-	-	-
	2000	0.947	0.988	0.958	drs	6.167	8.667	-142	-42,978	-	-	-1.167
North Eastern	2004	0.843	0.973	0.866	drs	15.200	21.200	-426	-548,284.8	-	-5.0	-6.2
	2012	0.676	1.000	0.676	drs	-	-	-	-	-	-	-
Nairobi	2000	0.627	0.100	0.627	drs	-	-	-	-	-	-	-
	2004	0.629	1.000	0.629	drs	-	-	-	-	-	-	-
	2012	0.488	1.000	0.488	drs	-	-	-	-	-	-	-
Nyanza	2000	1.000	1.000	1.000	-	-	-	-	-	-	-	-
	2004	1.000	1.000	1.000	-	-	-	-	-	-	-	-
	2012	1.000	1.000	1.000	-	-	-	-	-	-	-	-
	2000	1.000	1.000	1.000	-	-	-	-	-	-	-	-
Rift valley	2004	0.877	0.946	0.927	drs	31.778	50.444	-45.22	-57,659.33	-0.778	-	-0.556
	2012	0.793	0.936	0.848	drs	36.794	48.458	-90.315	-83,609.27	-	-	-
Western	2000	0.884	0.940	0.940	drs	33.333	37.834	-10.5	-139,064	-	-	-0.333
	2004	0.892	0.955	0.935	drs	25.800	28.800	-96	-123,474	-	1	-0.8
	2012	0.693	0.895	0.774	drs	60.224	63.656	-132.525	-123,384.7	-	-1.888	-

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012

The outcomes exhibited in Table 4.19 sketched input and output changes that happened in different regions in 2000, 2004 and 2012. In 2000, schools in Coast, Nyanza, and Rift valley regions showed 100 percent levels of technical efficiency. After the implementation of the FPE program in 2004, schools in Eastern and Nyanza regions accomplished a 100 percent efficiency level while in 2012 just schools in Coast, Eastern, and Nyanza regions had accomplished an efficiency level of 100 percent. Within the three-time periods where 100 percent efficiency levels were not accomplished for schools within the regions that displayed diminishing returns to scale.

Further, schools in the Western region recorded the highest number of scores that should have been achieved for a school to accomplish a 100 percent level of efficiency for the years 2000, 2004 and 2012. This was accumulated to a mean interest somewhere in the range of 25 and 63 scores for arithmetic and reading. Moreover, schools in the Rift valley region dropped in both arithmetic and reading scores to make the region efficient. The drop was overseen by expanding the schools' performance by a mean between 31 and 50 scores for both arithmetic and reading. The investigation further demonstrated that schools from the Central, Coast, Eastern and North Eastern regions had a mean-variance of between 1.7 and 36 scores to make them achieve 100 percent efficiency levels. In any case, schools situated in Nairobi and Nyanza regions had no output changes however the schools in Nairobi region showed diminishing returns to scale in its efficiency examination.

The input changes demonstrated that schools found Nairobi and Nyanza regions didn't require any change in their data inputs, in any case, in 2000, 2004 and 2012, the schools in the Western region expected to diminish the number of students enrolled in schools, measure of government expenditure allocated per school, total classes and total teachers respectively. This would assist the region to achieve 100 percent efficiency levels. A similar pattern was important for Rift valley region in 2004 and 2012 where input reduction was key for the number of students selected and the amount of government expenditure allocated. The required negligible changes for all total classes and teachers respectively. In the analysis, for the schools situated in Central, Coast, Eastern and North-eastern regions, the inputs provided a noteworthy decrease generally in 2004 despite the fact that this pattern was important for schools in Eastern and North-Eastern region in 2000

4.6.2 Determinants of Inefficiency in Technical Efficiency

To appraise the determinants of efficiency, in most cases second stage analysis carried out using the Tobit model or through bootstrapping. In a couple of cases, the second stage investigation utilizing the Tobit model was censured by its probability of predisposition on little examples with a proposition to apply option and deduction strategies dependent on bootstrap techniques. To condense these impediments, Afonson and Anbyn (2006) contended that bootstrap and Tobit results were the equivalents. Accordingly, the investigation for determinants of efficiency utilized the Tobit regression analysis clarified in condition 3.50. The regression carried out with the dependent variable included as the degrees of inefficiency which were either 0 or 1 ($u_i = (1 - effieicny$) . The explanatory variables that were utilized in

the regression model included input variables and associated dummies. The results from the regression analysis were represented in Table A7.

The outcomes displayed in Table A7 demonstrated that school attributes were analyzed against efficiency scores. It was likewise noticed that coefficients for student-class ratio, pupil-toilet ratio, and the distance of the school from a small town, dispensary, bookshop, and secondary school as well as class types were negative on school efficiency levels. Hence, a minimal increment in the quantity of these factors in the country would expand levels of inefficiency per school.

Furthermore, coefficients for pupil-class, pupil-book ratio, government expenditure, availability of playfield and the number of classes in a school were positive for levels of inefficiency; in this way, an expansion in the quantities of these factors in the country would increase the degrees of efficiency per school. The outcomes likewise demonstrated that coefficients for schools' schools' locations were positive especially for schools located near main road and library would contribute towards higher levels of efficiency. Further, the outcomes indicated high results showed high statistical significance at 1 percent, 5 percent and 10 percent levels in 2000, 2004 and 2012 respectively for school location near main road and library. These outcomes were practically identical with Muvawala and Hisali (2012) who textbooks, teachers, and desks were significant at a 5 percent statistical significance level in Uganda's primary education system.

Further, in spite of the fact that the coefficients for the total number of teachers were negative for levels of efficiency; scale efficiency was

statistically significant at 1 percent and 5 percent levels respectively in 2012 for both total number of teachers and the number of female teachers in a school respectively. In 2000 under CRSTE, VRSTE, and SE, the outcomes indicated that coefficients for teachers with no experience, those with under 1 and 2 years' of experience and those with over 3 years of teaching experience contributed positively to levels of school efficiency. It was, in any case, set up that coefficients for teachers with at least 3 years of teaching experience were negative for levels of school efficiency both at CRSTE and SE.

In analysing teachers' academic qualifications; the results showed that in almost all categories (teachers with primary school education to those with a tertiary level of education) contributed positively to school efficiency levels except for teachers' age under CRSTE and SE in 2000. In addition, coefficients for teachers with a primary level of education were negative for efficiency in 2004; thus, an increase in the number of teachers with primary education in the country would reduce levels of school efficiency. Further, coefficients for teachers with a secondary level of education and those with tertiary level of education were negative for school efficiency scores in 2012.

The outcomes exhibited showed that determinants of efficiency given school from various facilities, pupil-class ratio and pupil-toilet ratio whose coefficients were negative for efficiency scores. However, coefficients for pupil class, pupil-book ratio, government expenditure, teacher characteristics and availability of playfield were positive and statistically significant between 1 percent and 5 percent (Raposo and Menezes, 2011; Muvawala and Hisali, 2012; Shiozawa, 2016).

4.6.3 Technological Change in Technical Efficiency

Utilizing the Solow model on productivity analysis $Y = AK^{\alpha}L^{\beta}$ represented impacts in total output when inputs were represented to decide a proportion of technological dynamism. The school inputs and outputs for 2004 and 2012 indicated that they had added to the levels of efficiency accomplished. Utilizing the period 2000 as the base year, Total Factor Productivity measures were included for the overall efficiency change, the technological efficiency change, scale efficiency change, pure technological efficiency and aggregated TFP as introduced in Table 4.20.

Table 4.20: Technological efficiency analysis for 8 regions (2000, 2004 and 2012)

Region Name	Year	Efficiency change	Technical efficiency change	scale efficiency change	Pure technological efficiency	Total factor productivity[5]
North Eastern	2004	0.814	0.789	1.034	0.788	0.643
	2012	1.03	0.897	0.942	1.942	0.925
	Mean	0.916	0.842	0.987	0.928	0.771
Central	2004	0.935	0.985	1.000	0.935	0.921
	2012	1.256	***	1.019	1.232	***
	Mean	1.084	***	1.01	1.074	***
Coast	2004	0.908	1.147	1.009	0.9	1.042
	2012	0.926	1.014	0.923	1.003	0.939
	Mean	0.917	1.079	0.923	0.95	0.989
Eastern	2004	0.914	1.22	0.974	0.939	1.115
	2012	1.096	1.026	1.019	1.075	1.125
	Mean	1.001	1.119	0.996	1.005	1.12
Nairobi	2004	1.05	227.837	1.005	1.045	239.211
	2012	0.716	1.506	0.937	0.764	1.078
	Mean	0.867	18.521	0.97	0.893	16.055
Nyanza	2004	0.849	1.163	0.957	0.0888	0.988
	2012	1.211	0.855	1.061	1.142	1.035
	Mean	1.014	0.997	1.007	1.007	1.011
Rift valley	2004	0.795	0	0.939	0.847	0
	2012	1.127	0.853	1.058	1.065	0.961
	Mean	0.946	0	0.997	0.949	0
Western	2004	1.251	0.902	1.06	1.18	1.128
	2012	0.984	0.48	0.989	0.996	0.736
	Mean	1.109	0.821	1.024	1.084	0.911

Source: Authors Computation, Based on SACMEQ Survey data, 2000; 2004; 2012

[5]In TE under time periods t=1… T and the production technology at time t is P^t, then $P^t = \{(x^t, y^t) : x^t$ can produce $y^t\}$. To assess changes in productivity over time, two time periods producing the above results can be defined as: $D_0^t(x^{t+1}, y^{t+1}) = \min\{\theta : x^{t+1}, y^{t+1}/\theta \in P^t\}$ at time t and $D_0^{t+1}(x^t, y^t) = \min\{\theta : x^t, y^t/\theta \in P^{t+1}\}$ at time t+1

The analysis presented in Table 4.20, explained that efficiency change for all regions was positive except for schools in Nairobi and Western regions which had an efficiency change levels of -33.4 percent and -26.7 percent after implementation of FPE i.e. between 2000 and 2004. However, between 2004 and 2012, efficiency changes were negative for schools in all the regions except for Nairobi and Western regions which had efficiency change levels between 15.1 percent and 12.5 percent.

The trends in efficiency changes were also evident within technical efficiency change (TEC), scale efficiency change (SE), pure technological efficiency (PE) and total factor productivity (TFP). The analysis further showed that schools located in Nairobi and Rift Valley regions had the highest total factor productivity (TFP) between 2000 and 2004 of over -200 percent and -96 percent respectively and at the same change which was positive between 2004 and 2012.

CHAPTER FIVE
SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Introduction

This chapter covers the study summary, as well as the conclusions made from the study as well as the contribution to knowledge that has been made by the study, key policy recommendations and proposed areas of more research.

5.2 Summary of the Study

The notable increase in budgetary allocation by the government towards the sector on education was necessitated by its effort to achieve universal primary education and in line with the Social Pillar of Vision 2030 and global Sustainable Development Goal number four of Universal Primary Education. The budget allocation increased from 6.2 percent of the proportion of the Gross Domestic Product (GDP) in 2002/03 to 7.4 percent in 2005/06. It, however, dropped to 5.3 percent in 2014/15 and further to 5.24 in 2017/18. As a result, Gross Enrolment Rate rose to 104 percent in 2003 from 92 percent in 2002 and further rose to 105.3 percent in 2017. As a consequence, pupil-teacher and pupil-class ratios increased from 36:1 and 42:1 to 45:1 and 57:1 between 2002/03 and 2012/03 and further 42:1 and 55:1 in 2017, respectively. Despite the increased expenditure on the education sector by the government, the changes in levels of enrolment were not in tandem with the trends of increased government expenditures, further, these in enrolment further compromised the education quality and schools' levels of technical efficiency were compromised.

To address the problem identified, this study was guided by three objectives: (i) to establish the effect of government expenditure on enrolment in public primary schools in Kenya; (ii) to determine the effect of government expenditure on the quality of education in public primary schools in Kenya; and (iii) to measure the contribution of government expenditure to levels of technical efficiency in public primary schools in Kenya. In addition, the data used in the study used pseudo-panel data that was collected from the class six scores undertook by the South African and Eastern Consortium for Monitoring Education Quality nation-wide surveys of 2000, 2004, and 2012. More data was collected from the Kenya National Examination Council and Statistical Abstracts for the years between 1997-2018.

The results achieved from the regression analysis answering the objective one on the effect of expenditures by the government on levels of enrolment indicated that the public primary school's levels of general enrolment in significantly increased over the three-time periods though a significant change was observed between 2004 and 2012. There was also a significant increase in the number of schools in rural areas in both time periods (2000-2004) and (2004 -2012) after the FPE introduction in 2003. However, however, changes in school locations were not directly related to the three-timeframes.

With this expansion, student-class proportion, pupil toilet proportion, student book proportion, and pupil-teacher proportion were higher in the two time periods. Also, a large portion of the schools had a higher number of permanent classes just as the number of teachers per school in 2000, 2004 and 2012 individually. Regarding the effect of government expenditure on enrolment,

the outcomes found that school-related attributes were noteworthy with enrolments. A portion of the schools' related attributes that influenced enrolment included student class proportion and pupil-teacher proportions in given schools. The analysis further showed that distances from various social amenities negatively affected enrolment, especially in rural areas.

The analysis of the second objective on the impact of government expenditure on the quality of education found that government expenditure decidedly affected reading and arithmetic scores. The education quality of education was also informed by affected by pupil-book ratio, availability of playfield pupil, pupil-class ratio, availability of playfield, and class types and pupil-book ratio. In addition, types of classes influenced scores with open classes having a negative effect negatively affecting the education quality, while coefficients for classes that were quality of education while permanent and temporary classes had positively positive effects affected education quality. Other key determinants for quality of education included school location, school possession, teachers' qualifications, and experience.

The outcomes from the analysis discussing the third objective on the commitment of government consumption to school technical efficiency noted that effectiveness and efficiency results among schools in different areas dropped after FPE implementation, however, demonstrated an expansion in productivity by 2012 when the program stabilized. A few factors were likewise found to have added to the degrees of inefficiency in various time

periods. Among the factors that added to the levels of efficiency in the schools included class types and school locations.

5.3 Conclusions

It very well may be presumed that government expenditure is an imperative input that catalyzes expanded access to education at primary level in Kenya. This was on the grounds that the constructive outcome of government expenditure on enrolment in every one of the three years viable.

Also, government backing to schools t during the period added to progress in the performance as estimated by arithmetic and reading scores accomplished by the students. The outcomes indicated a solid positive impact of government expenditure on measures of quality of education.

Finally, the ideal and optimal use of the available resource would bring about significant levels of productivity in schools. A portion of the key areas that the government would deliver to accomplish significant levels of school efficiency included student class ratio, pupil-teacher ratio, pupil-book proportion, pupil-toilet ratio, pupil-teacher ratio, school distance from a small town, dispensary, bookshop, and secondary school as well as class types.

5.4 Contribution to Knowledge

The findings in this study showed that the government expenditure on schools helped in achieving improved outcomes in the education sector. The study findings contributed an integrated approach to the measurement of school

performance to include indicators such as enrolment, education quality, and levels of schools' technical efficiency. Although, reviewed literature highlighted education quality from the perspective of results achieved in the KCPE examinations which were qualifying examination results for the transition to secondary schools. It was notable that, in most cases, these results were biased as pupils were prepared for and conditioned towards coaching for the KCPE examination. This study measured the quality of education using class six evaluation scores, which were assumed that the scores were collected at a point where there existed no levels of bias. The findings, therefore, provided a more significant relationship between government expenditures on education and quality of education.

Further, in instances where regression analysis was used in the analysis, the majority of studies used either pure panel data or cross-sectional; this study applied the pseudo-panel data that integrated both panel and cross-sectional data sets.

5.5 Policy Implications

First, the government should enhance its expenditure on primary education. Notably, increased government expenditure increases levels of enrolment in line with the Universal Primary Education (UPE) and Education for All (EFA) as stipulated in the Sustainable Development Goals number four on education. Further, it would be important, a share of the expenditure is used to increase the number of classes in the school, the number of toilets, and the number of classes as well as improving teacher training.

Secondly, policymakers would consider allocations of resources to school inputs that have a higher impact on school performance such as books and classroom types. This would enhance effectiveness with increased government financing to primary education.

Thirdly, government expenditure allocated to primary education should be used to enhance levels of the qualification of teachers within primary schools. This consideration was highlighted in the study findings. The findings further, showed that the contribution of teacher qualification and teacher experience was a critical factor in enhancing the quality of education.

Fourthly, the national government, with the support of the county government and other development partners should also take lead in the provision of improved school infrastructure, provide school-related inputs that would enhance the school's operations. The improvement should, however, be in line with government policies to ensure that inputs were conveniently availed to the schools. This policy implication was guided by the findings in this study that highlighted key areas that would enhance technical efficiency. One of the key areas of intervention was the improvement of the structure of the building and related infrastructure in schools as well as school location with much bias in the town or urban area.

Finally, the policies make in the education ministry need to harmonize analysis of efficiency determination to understand how resources allocated in the sector are utilized. This efficiency framework should partly integrate the unit costs of education, which is disaggregated by county, sub-county and

ward levels. This analysis would be critical in the implementation of the 2-6-3-3-3- system of education. The resulting impact of this process would be the institutionalization of the education sector.

5.6 Limitation of the study

Several limitations were experienced during the development of this study. A notable study limitation was the data gap as illustrated by the available data. The data period between 2000, 2004 and 2012 respectively. The nonlinearity of the data warranted for estimation of a mean for 2008; however, this would have caused multi-collinearity effects if subjected to regression analysis, hence affecting the results. In addition, the existing data sets for 2000, 2004 and 2012 were not as recent as expected during the study period. The SACMEQ IV that was to be released in 2018; delayed due to national administrative reasons; hence the study had to rely on the available data, with the current data been in 2012. Further, the data collection process targeted provinces which were non-existence with the devolution process within the Constitution of Kenya, 2010. The emergence of the county governments led to the overall decentralization of the data by regions hence the data sets were disaggregated into counties and clustered to regions that may not have been factored during sampling.

5.7 Areas of Further Research

This study analysed the performance of public primary schools in Kenya given the time available for data collection. However, to identify overall performance in the primary education levels, a further study for incorporating

both private schools and public primary schools should be carried out disaggregated by counties.

In addition, the study applied evaluation outcomes for class six pupils which were undertaken within the unbiased environment. A comparison between class six and class eight scores were not compared as measures of quality of education to be used in the study. Further, to the determination of where the government needs to spend its resources, it is prudent to undertake a study that compared the test scores under SAECMEQ and the results acquired from the KCPE examinations. The analysis can be facilitated based on the information provided through National Education Management Information system (NEMIS). The outcome of further research would highlight levels of school performance both in both biased and unbiased environment.

This study further used the dataset for the years 2000, 2004 and 2012. During the period of study, SACMEQ IV (2019) was expected but could not be available for use since it had not been released during the period of study. A further study integrating 2000, 2004, 2012 and 2019 should be undertaken. The outcome of the study would help formulate a model for determining school performance using pseudo-panel data.

In reference to the reviewed literature, there existed no study on the education unit costs of as well as determination on the return on investment on education in relation to other sectors. The use of a Computable General Equilibrium (CGE) perspective could provide reputable indicators for policy use. A further study could highlight the unit costs of education at national and county levels schools for both schools owned by private entities private as well as the

public-owned primary schools in Kenya. The outcome of the study would help policymakers determine the actual outcome of government expenditure on school performance

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APPENDICES

Table A1: Tests for Multicollinearity

Variables	**VIF**	**1/VIF**
Permanent classes	6.608	0.0151
Rural towns	5.475	0.0182
Total classes	5.029	0.0198
Large towns	3.818	0.0262
Small towns	3.75	0.0267
Temporary classes	1.137	0.0879
Isolated	0.708	0.1413
Total Toilet	0.244	0.4103
Open classes	0.238	0.4104
Distance from Library	0.19	0.5261
Distance from Bookshop	0.161	0.6206
School possession	0.153	0.6522
Distance from road	0.146	0.6839
Government expenditure	0.145	0.6896
Distance from Clinic	0.119	0.8397
Distance from secondary school	0.111	0.9017
Availability of playfield	0.107	0.9356
Mean VIF	1.655	0.412076

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012

Table A2: Test for Random and Fixed Effect

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	Random	Fixed	Difference	S.E.
Government Expenditure	1.52E-28	1.02E-29	1.41E-28	2.14E-17
Total classes	2.33E-24	2.07E-24	2.60E-25	3.98E-12
Number of Toilets	-3.67e-24	-3.2e-26	-3.6e-24	3.41E-13

Total school possession	1.06E-23	2.59E-25	1.03E-23	1.09E-12
Availability of playfield	-2.35e-24	-1.92e-24	-4.23e-25	5.93E-12
school distance from clinic	1.17E-24	7.24E-26	1.10E-24	6.16E-13
School distance from road	-1.08e-25	-4.29e-27	-1.04e-25	7.07E-14
School distance from library	-1.6e-25	4.37E-28	-1.61e-25	6.47E-14
School distance from bookshop	2.63E-25	3.81E-26	2.25E-25	4.10E-12
Permanent classes	-3.1e-24	-2.22e-24	-8.74e-25	4.10E-12
Temporary classes	-5.41e-24	-2.34e-24	-3.06e-24	4.19E-12
Open classes	-4.66e-24	-2.1e-24	-2.56e-24	4.49E-12
School Location				
Isolated	8.31E-22	7.42E-25	8.30E-22	5.56E-11
Rural area	9.07E-22	4.33E-24	9.02E-22	5.37E-11
Small town	8.83E-22	4.44E-24	8.78E-22	5.31E-11
b = consistent under Ho and Ha; obtained from xtreg				
B = inconsistent under Ha, efficient under Ho; obtained from xtreg				
Test: Ho: difference in coefficients not systematic				
chi2(16) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 0.00				
Prob>chi2 = 0.045000 (If this is < 0.05 (i.e. significant) use fixed effects)				

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012

Table A3: Fixed Effect tests for School Characteristics

	Fixed Effects			
Variables		2000	2004	2012
Government Expenditure	Within	0.2909	1	1
	Between	0.7518	1	1
	Rho	0.513	0.241	0.273
School characteristics	Within	0.825	1	1
	Between	0.946	1	1
	Rho	0.412	0.563	0.432
	Correlation(u-I,xb)	0.474	-0.04	-0.3
School locations	Within	0.546	1	1
	Between	0.978	1	1
	Rho	0.298	0.23	0.271
	Correlation(u-I,xb)	0.723	-0.321	0.147
Distance from Social Amenities	Within	0.319	1	1
	Between	0.9108	1	1
	Rho	0.5211	0.2256	0.297
	Correlation(u-I,xb)	0.6589	-0.3905	0.0894
Class types	Within	0.362	0	1
	Between	0.916	1	1
	Rho	0.505	0.312	0.268
	Correlation(u-I,xb)	0.645	0.105	0.163

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012

Table A4: Government Expenditure and Arithmetic and Reading Scores

	Arithmetic Score			Reading Score		
	2000	2004	2012	2000	2004	2012
Government Expenditure	31.86*** (9.876)	18.95*** (8.701)	20.59*** (9.075)	33.04*** (10.53)	34.60*** (9.557)	36.62*** (10.01)
R-Squared	1.000	1.000	1.000	1.000	1.000	1.000

*** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012

Table A5: Technical Efficiency Measures in 2000, 2004 and 2012

North Eastern	**Constant Returns to Scale TE**			**Variable Returns to Scale TE**			**Scale Efficiency TE**		
Efficiency Levels	2000	2004	2012	2000	2004	2012	2000	2004	2012
<0.5	33.3	50.0	33.3	8.3	8.3	0.0	8.3	33.3	25.0
0.51-0.8	41.7	25.0	41.7	8.3	0.0	25.0	50.0	16.7	16.7
0.81-0.99	16.7	8.3	25.0	75.0	66.7	50.0	8.3	25.0	16.7
1	8.3	16.7	25.0	8.3	25.0	25.0	33.3	25.0	41.7
mean	0.69	0.59	0.67	0.90	0.93	0.88	0.77	0.63	0.76
Central	**Constant Returns to Scale TE**			**Variable Returns to Scale TE**			**Scale Efficiency TE**		
Efficiency Levels	2000	2004	2012	2000	2004	2012	2000	2004	2012
<0.5	16.7	16.7	0.0	0.0	0.0	0.0	0.0	4.2	0.0
0.51-0.8	54.2	66.7	45.8	16.7	0.0	12.5	62.5	70.8	25.0
0.81-0.99	8.3	0.0	33.3	50.0	75.0	45.8	12.5	8.3	54.2
1	20.8	16.7	20.8	33.3	25.0	41.7	25.0	16.7	20.8
Mean	0.72	0.67	0.83	0.91	0.91	0.93	0.79	0.74	0.89
Coast	**Constant Returns to Scale TE**			**Variable Returns to Scale TE**			**Scale Efficiency TE**		
Efficiency Levels	2000	2004	2012	2000	2004	2012	2000	2004	2012
<0.5	0.0	6.3	6.3	0.0	0.0	0.0	0.0	0.0	0.0
0.51-0.8	25.0	37.5	43.8	6.3	6.3	25.0	18.8	25.0	43.8
0.81-0.99	37.5	25.0	18.8	43.8	43.8	50.0	37.5	43.8	25.0
1	37.5	31.3	31.3	50.0	50.0	25.0	43.8	31.3	31.3
Mean	0.88	0.81	0.93	0.95	0.96	0.85	0.93	0.89	0.85
Eastern	**Constant Returns to Scale TE**			**Variable Returns to Scale TE**			**Scale Efficiency TE**		
Efficiency Levels	2000	2004	2012	2000	2004	2012	2000	2004	2012
<0.5	8.3	20.8	16.7	0.0	0.0	0.0	0.0	8.3	0.0

0.51-0.8	45.8	41.7	25.0	8.3	16.7	12.5	50.0	37.5	33.3
0.81-0.99	16.7	16.7	33.3	50.0	50.0	54.2	12.5	29.2	37.5
1	29.2	20.8	20.8	41.7	33.3	33.3	37.5	25.0	29.2
Mean	0.78	0.73	0.79	0.93	0.91	0.93	0.84	0.80	0.85
Nairobi	**Constant Returns to Scale TE**			**Variable Returns to Scale TE**			**Scale Efficiency**		
Efficiency Levels	2000	2004	2012	2000	2004	2012	2000	2004	2012
<0.5	0.0	0.0	12.5	0.0	0.0	0.0	0.0	0.0	12.5
0.51-0.8	25.0	18.8	62.5	0.0	0.0	12.5	6.3	6.3	43.8
0.81-0.99	56.3	43.8	18.8	50.0	43.8	56.3	75.0	50.0	37.5
1	18.8	37.5	6.3	50.0	56.3	31.3	18.8	43.8	6.3
Mean	0.87	0.91	0.67	0.96	0.96	0.90	0.91	0.95	0.74
Nyanza	**Constant Returns to Scale TE**			**Variable Returns to Scale TE**			**Scale Efficiency TE**		
Efficiency Levels	2000	2004	2012	2000	2004	2012	2000	2004	2012
<0.5	5.0	25.0	10.0	0.0	0.0	0.0	5.0	15.0	10.0
0.51-0.8	35.0	35.0	40.0	0.0	5.0	0.0	35.0	35.0	15.0
0.81-0.99	30.0	25.0	25.0	55.0	70.0	55.0	20.0	35.0	30.0
1	30.0	15.0	25.0	45.0	25.0	45.0	40.0	15.0	45.0
Mean	0.80	0.68	0.81	0.94	0.90	0.95	0.85	0.75	0.85
Rift valley	**Constant Returns to Scale TE**			**Variable Returns to Scale TE**			**Scale Efficiency TE**		
Efficiency Levels	2000	2004	2012	2000	2004	2012	2000	2004	2012
<0.5	0.0	14.3	0.0	0.0	0.0	0.0	0.0	3.6	0.0
0.51-0.8	25.0	60.7	53.6	7.1	17.9	0.0	10.7	46.4	50.0
0.81-0.99	50.0	7.1	32.1	50.0	57.1	67.9	64.3	28.6	21.4
1	25.0	17.9	14.3	42.9	25.0	32.1	25.0	21.4	28.6
Mean	0.87	0.71	0.79	0.94	0.88	0.93	0.93	0.80	0.85
Western	**Constant Returns to Scale TE**			**Variable Returns to Scale TE**			**Scale Efficiency TE**		
Efficiency Levels	2000	2004	2012	2000	2004	2012	2000	2004	2012
<0.5	25.0	5	20.0	0.0	0.0	0.0	20.0	5.0	10.0
0.51-0.8	60.0	50	20.0	15.0	0.0	5.0	55.0	40.0	30.0
0.81-0.99	0.0	20	35.0	60.0	65.0	35.0	10.0	25.0	35.0
1	15.0	25	25.0	25.0	35.0	60.0	15.0	30.0	25.0
Mean	0.62	0.76	0.77	0.90	0.95	0.94	0.69	0.80	0.81

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012

Table A6: Efficiency and Malmquist Productivity Results

EFFICIENCY RESULTS PER SCHOOL IN 8 REGIONS										PRODUCTIVITY EFFICIENCY FOR EACH SCHOOL IN THREE YEARS				
Region	**2000**			**2004**			**2012**							
North Eastern	**CRSTE**	**VRSTE**	**SE**	**CRSTE**	**VRSTE**	**SE**	**CRSTE**	**VRSTE**	**SE**	**Efficiency change**	**Technical efficiency change**	**Scale efficiency change**	**Pure technical efficiency**	**Total factor productivity**
1	1.00	1.00	1.00	0.49	0.83	0.59	1.00	1.00	1.00	1.00	0.50	1.00	1.00	0.50
2	0.25	0.81	0.30	0.87	1.00	0.87	0.50	0.89	0.56	1.42	0.94	1.05	1.36	1.34
3	0.67	0.85	0.78	1.00	1.00	1.00	0.83	0.93	0.90	1.12	0.86	1.05	1.07	0.96
4	0.66	0.84	0.78	0.28	0.84	0.34	0.82	0.82	1.00	1.12	0.86	0.99	1.13	0.97
5	0.89	0.95	0.94	0.33	0.10	3.28	0.24	0.79	0.30	0.52	0.91	0.91	0.57	0.47
6	0.62	0.97	0.64	0.29	0.89	0.32	0.56	0.90	0.61	0.95	0.92	0.96	0.98	0.88
7	0.79	0.79	1.00	0.82	0.96	0.85	0.42	0.85	0.49	0.73	0.75	1.04	0.70	0.55
8	0.38	0.92	0.42	0.32	0.81	0.39	1.00	1.00	1.00	1.62	1.14	1.04	1.55	1.83
9	0.64	0.85	0.75	0.32	0.94	0.34	0.78	0.78	1.00	1.11	0.79	0.96	1.15	1.83
10	0.45	0.84	0.54	1.00	1.00	1.00	0.81	0.90	0.90	1.34	0.87	1.04	1.29	0.90
11	0.99	0.99	1.00	0.57	0.96	0.59	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.90
12	0.10	0.10	1.00	0.80	0.93	0.86	0.05	0.70	0.07	0.23	0.82	0.84	0.27	0.19
Mean	0.69	0.90	0.77	0.59	0.93	0.63	0.67	0.88	0.76	0.92	0.84	0.99	0.93	0.77

Region	2000			2004			2012							
Central	**CRSTE**	**VRSTE**	**SE**	**CRSTE**	**VRSTE**	**SE**	**CRSTE**	**VRSTE**	**SE**	**Efficiency change**	**Technical efficiency change**	**scale efficiency change**	**pure technical efficiency**	**Total factor productivity**
1	0.91	0.98	0.93	0.75	0.96	0.78	0.91	0.95	0.95	1.00	0.97	0.99	1.01	0.97
2	0.65	0.88	0.73	0.60	0.86	0.70	0.61	0.81	0.74	0.97	0.90	0.96	1.01	0.87
3	0.57	0.80	0.71	1.00	1.00	1.00	0.62	0.86	0.72	1.05	0.94	1.04	1.01	0.98
4	0.79	0.96	0.83	0.71	0.94	0.75	1.00	1.00	1.00	1.12	1.00	1.02	1.10	1.13
5	1.00	1.00	1.00	0.52	0.82	0.64	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89
6	0.91	0.91	1.00	0.61	0.81	0.76	0.79	0.84	0.94	0.93	0.90	0.96	0.97	0.83
7	0.63	0.88	0.71	1.00	1.00	1.00	0.72	0.86	0.84	1.07	0.99	0.99	1.08	1.06
8	0.72	0.92	0.78	0.42	0.83	0.51	0.63	0.78	0.80	0.93	0.85	0.92	1.02	0.80
9	0.59	0.81	0.72	0.55	0.82	0.67	0.95	1.00	0.95	1.28	0.91	1.11	1.15	1.16
10	0.56	0.88	0.64	1.00	1.00	1.00	0.89	0.95	0.94	1.26	0.94	1.04	1.22	1.18
11	0.75	1.00	0.75	0.50	0.85	0.59	0.88	0.99	0.89	1.08	0.88	0.10	1.09	0.95
12	0.36	0.72	0.51	0.53	0.86	0.62	0.76	0.86	0.89	1.45	0.91	1.09	1.33	1.32
13	0.44	0.80	0.55	0.87	0.93	0.94	0.76	0.92	0.82	1.31	0.88	1.07	1.22	1.15
14	0.73	0.87	0.84	0.75	0.84	0.90	1.00	1.00	1.00	1.17	***	1.07	1.09	***
15	0.61	0.86	0.71	0.59	0.87	0.68	0.63	0.86	0.74	1.02	0.93	1.00	1.02	0.95
16	0.48	0.76	0.63	0.65	0.91	0.71	0.57	0.80	0.71	1.09	0.91	1.02	1.06	0.99
17	0.51	1.00	0.51	0.40	0.82	0.49	0.92	1.00	0.92	1.35	0.87	1.00	1.35	1.17
18	1.00	1.00	1.00	0.63	0.93	0.68	1.00	1.00	1.00	1.00	1.18	1.00	1.00	1.18

19	1.00	1.00	1.00	0.46	0.90	0.51	0.91	0.96	0.95	0.95	0.88	0.98	0.97	0.84
20	0.76	0.98	0.78	0.74	0.98	0.76	0.99	1.00	0.99	1.14	1.12	1.01	1.13	1.28
21	1.00	1.00	1.00	0.64	1.00	0.64	1.00	1.00	1.00	1.00	0.73	1.00	1.00	0.73
22	1.00	1.00	1.00	0.54	0.87	0.62	0.88	1.00	0.88	0.94	1.02	1.00	0.94	0.96
23	0.48	0.81	0.60	0.59	1.00	0.59	0.71	1.00	0.71	1.22	1.02	1.11	1.10	1.23
24	0.80	1.00	0.80	1.00	1.00	1.00	0.68	0.80	0.85	0.93	1.00	0.90	1.03	0.93
Mean	0.72	0.91	0.79	0.67	0.91	0.74	0.83	0.93	0.89	1.08	***	1.01	1.07	888.00

Region	2000			2004			2012							
Coast	**CRS TE**	**VRS TE**	**SE**	**CRS TE**	**VR STE**	**SE**	**CR STE**	**VR STE**	**SE**	**Efficiency change**	**Technical efficiency change**	**scale efficiency change**	**pure technical efficiency**	**Total factor productivity**
1	1.00	1.00	1.00	0.76	0.91	0.83	1.00	1.00	1.00	1.00	1.19	1.00	1.00	1.19
2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	0.66	0.83	0.80	0.60	0.79	0.76	0.83	0.93	0.88	1.12	1.10	1.06	1.05	1.23
4	1.00	1.00	1.00	0.95	1.00	0.95	0.47	0.80	0.59	0.69	1.04	0.90	0.77	0.71
5	0.90	0.94	0.96	1.00	1.00	1.00	0.65	0.77	0.84	0.85	0.91	0.91	0.94	0.78
6	0.55	0.91	0.61	0.89	0.97	0.91	0.62	0.84	0.74	1.06	1.08	0.96	1.10	1.14
7	0.99	1.00	0.99	0.73	0.91	0.81	0.57	0.82	0.69	0.76	1.08	0.91	0.84	0.82
8	0.76	0.97	0.78	0.73	0.85	0.86	0.80	0.84	0.95	1.02	1.16	0.93	1.10	1.19
9	1.00	1.00	1.00	1.00	1.00	1.00	0.47	0.76	0.62	0.68	0.96	0.87	0.79	0.66

10	1.00	1.00	1.00	1.00	1.00	1.00	0.63	0.85	0.74	0.79	1.08	0.92	0.86	0.85
11	0.92	0.92	1.00	0.96	1.00	0.96	0.96	0.96	1.00	1.02	1.11	1.02	1.00	1.14
12	0.67	0.80	0.84	1.00	1.00	1.00	0.82	0.93	0.88	1.11	1.13	1.08	1.02	1.25
13	1.00	1.00	1.00	0.81	1.00	0.81	0.68	0.85	0.80	0.83	0.98	0.92	0.90	0.81
14	0.91	0.93	0.97	0.52	0.98	0.53	1.00	1.00	1.00	1.05	1.16	1.04	1.01	1.22
15	0.83	0.86	0.96	0.56	0.96	0.59	1.00	1.00	1.00	1.10	1.16	1.08	1.02	1.27
16	0.91	1.00	0.91	0.49	0.95	0.52	0.59	0.80	0.74	0.81	1.17	0.90	0.90	0.94
Mean	0.88	0.95	0.93	0.81	0.96	0.85	0.76	0.89	0.85	0.92	1.08	0.97	0.95	0.99

	2000			**2004**			**2012**							
Eastern	**CRSTE**	**VRSTE**	**SE**	**CRSTE**	**VRSTE**	**SE**	**CRSTE**	**VRSTE**	**SE**	**Efficiency change**	**Technical efficiency change**	**scale efficiency change**	**pure technical efficiency**	**Total factor productivity**
1	0.63	0.83	0.76	0.91	0.91	1.00	0.93	0.94	0.99	1.22	1.33	1.07	1.14	1.63
2	1.00	1.00	1.00	0.69	0.83	0.83	1.00	1.00	1.00	1.00	1108.00	1.00	1.00	1.11
3	1.00	1.00	1.00	0.45	0.76	0.59	0.72	0.85	0.85	0.85	1.16	0.92	0.92	0.98
4	1.00	1.00	1.00	0.91	0.99	0.92	0.54	0.96	0.56	0.73	1.11	0.98	0.75	0.81
5	1.00	1.00	1.00	0.68	0.82	0.83	0.55	0.78	0.71	0.74	0.98	0.88	0.84	0.73
6	1.00	1.00	1.00	0.59	0.90	0.66	1.00	1.00	1.00	1.00	1.16	1.00	1.00	1.16
7	0.78	0.78	1.00	1.00	1.00	1.00	0.99	1.00	0.99	1.13	1.25	1.13	1.00	1.40
8	0.53	0.80	0.66	1.00	1.00	1.00	1.00	1.00	1.00	1.38	1.09	1.12	1.24	1.50
9	0.99	0.99	1.00	1.00	1.00	1.00	0.72	0.91	0.79	0.85	1.05	0.96	0.89	0.89

10	0.54	0.96	0.57	0.74	0.93	0.80	1.00	1.00	1.00	1.36	1.48	1.02	1.33	2.02
11	0.48	0.93	0.52	1.00	1.00	1.00	0.96	0.96	1.00	1.41	1.24	1.01	1.39	1.74
12	1.00	1.00	1.00	0.76	0.81	0.94	0.88	0.93	0.94	0.94	0.99	0.97	0.97	0.92
13	0.67	0.90	0.75	0.71	0.77	0.92	1.00	1.00	1.00	1.22	1.22	1.06	1.16	1.49
14	0.56	0.87	0.64	0.36	0.81	0.44	1.00	1.00	1.00	1.34	1.12	1.07	1.25	1502.00
15	0.73	0.98	0.75	0.38	1.00	0.38	0.45	0.73	0.61	0.79	0.94	0.87	0.91	0.74
16	0.48	0.90	0.53	0.99	1.00	0.99	0.81	0.85	0.95	1.30	1.04	0.97	1.34	1.35
17	1.00	1.00	1.00	0.57	0.86	0.66	0.84	0.93	0.90	0.92	0.89	0.96	0.95	0.82
18	0.63	0.81	0.77	0.61	0.96	0.63	0.69	0.98	0.70	1.05	1.04	1.10	0.96	1.90
19	0.76	1.00	0.76	0.88	0.94	0.93	0.47	0.94	0.50	0.78	1.12	0.97	0.91	0.87
20	0.81	0.89	0.91	0.67	0.96	0.70	0.49	0.83	0.59	0.78	1.15	0.97	0.81	0.90
21	0.95	0.95	0.99	0.74	1.00	0.74	0.72	0.80	0.91	0.88	1.22	0.91	0.96	1.07
22	0.74	1.00	0.74	0.45	0.77	0.58	0.45	0.89	0.51	0.78	1.08	0.94	0.83	0.85
23	0.97	1.00	0.97	0.42	0.79	0.53	0.86	1.00	0.86	0.95	1.16	1.00	0.95	1.10
24	0.60	0.81	0.75	1.00	1.00	1.00	0.86	0.94	0.91	1.19	1.10	1.08	1.11	1.31
Mean	0.78	0.93	0.84	0.73	0.91	0.80	0.79	0.93	0.85	1.00	1.12	1.00	1.01	1.12

	2000			**2004**			**2012**							
Nairobi	**CRSTE**	**VRSTE**	**SE**	**CRSTE**	**VRSTE**	**SE**	**CRSTE**	**VRSTE**	**SE**	**Efficiency change**	**Technical efficiency change**	**scale efficiency change**	**pure technical efficiency**	**Total factor productivity**

1	0.78	0.89	0.88	0.79	0.88	0.90	0.63	0.88	0.71	0.90	20.16	1.00	0.90	18.06
2	0.81	0.87	0.93	1.00	1.00	1.00	0.39	0.70	0.56	0.69	11.67	0.90	0.77	8.09
3	0.82	0.89	0.92	0.85	1.00	0.85	0.55	0.79	0.69	0.81	21.28	0.94	0.87	17.33
4	0.85	0.90	0.94	1.00	1.00	1.00	0.75	0.86	0.88	0.94	19.27	0.98	0.97	18.13
5	0.87	0.95	0.92	0.88	0.94	0.94	0.82	0.90	0.91	0.97	18.63	0.97	1.00	18.04
6	0.89	1.00	0.89	1.00	1.00	1.00	0.88	0.95	0.92	1.00	19.02	0.98	1.02	18.91
7	0.88	1.00	0.88	1.00	1.00	1.00	0.50	1.00	0.50	0.75	21.70	1.00	0.75	16.24
8	1.00	1.00	1.00	0.83	0.92	0.90	0.77	0.91	0.84	0.88	17.73	0.95	0.92	15.47
9	1.00	1.00	1.00	1.00	1.00	1.00	0.57	0.82	0.69	0.75	15.88	0.91	0.83	11.97
10	1.00	1.00	1.00	0.82	0.85	0.97	0.57	0.81	0.70	0.75	17.73	0.90	0.84	13.35
11	0.89	0.92	0.97	0.96	1.00	0.96	0.59	1.00	0.59	0.81	20.53	1.04	0.78	16.72
12	0.77	0.98	0.78	1.00	1.00	1.00	0.74	0.88	0.85	0.99	16.80	0.95	1.04	16.54
13	0.77	0.91	0.84	0.79	0.89	0.89	0.40	0.96	0.41	0.72	19.78	1.03	0.70	14.24
14	0.78	1.00	0.78	0.94	0.94	1.00	0.80	1.00	0.80	1.02	20.36	1.00	1.02	20.66
15	0.87	1.00	0.87	0.95	0.96	0.98	1.00	1.00	1.00	1.07	22.03	1.00	1.07	23.58
16	0.91	1.00	0.91	0.78	1.00	0.78	0.83	1.00	0.83	0.95	16.98	1.00	0.94	16.17
Mean	0.87	0.96	0.91	0.91	0.96	0.95	0.67	0.90	0.74	0.87	18.52	0.97	0.89	16.06

	2000			2004			2012							
Nyanza	**CRS TE**	**VRS TE**	**SE**	**CRS TE**	**VRSTE**	**SE**	**CRSTE**	**VRSTE**	**SE**	**Efficiency change**	**Technical efficiency change**	**scale efficiency change**	**pure technical efficiency**	**Total factor productivity**
1	1.00	1.00	1.00	0.53	0.93	0.56	0.89	0.89	1.00	0.94	0.96	0.94	1.00	0.90
2	0.82	0.92	0.89	0.56	0.93	0.60	0.58	0.94	0.62	0.85	1.06	1.01	0.84	0.90
3	0.61	1.00	0.61	0.70	0.82	0.86	0.79	0.88	0.89	1.14	0.94	0.94	1.21	1.07
4	0.25	0.83	0.30	1.00	1.00	1.00	0.43	1.00	0.43	1.32	1.02	1.10	1.20	1.34
5	0.63	0.88	0.71	0.29	0.87	0.34	0.55	1.00	0.55	0.94	0.96	1.06	0.88	0.90
6	0.60	0.91	0.66	0.41	0.85	0.48	0.93	0.93	1.00	1.24	0.95	1.01	1.23	1.19
7	0.82	0.82	1.00	0.47	0.81	0.58	0.77	0.96	0.81	0.97	0.96	1.08	0.90	0.93
8	0.92	0.95	0.97	0.50	0.90	0.56	0.53	1.00	0.53	0.76	1.02	1.03	0.74	0.77
9	1.00	1.00	1.00	0.59	1.00	0.59	0.47	0.94	0.50	0.68	1.07	0.97	0.70	0.73
10	0.62	0.85	0.73	0.81	0.83	0.97	1.00	1.00	1.00	1.27	1.07	1.08	1.17	1.35
11	1.00	1.00	1.00	0.53	0.80	0.67	0.95	1.00	0.95	0.98	0.91	1.00	0.98	0.89
12	1.00	1.00	1.00	0.61	0.88	0.69	0.83	0.98	0.84	0.91	0.98	0.99	0.92	0.89
13	1.00	1.00	1.00	0.86	0.97	0.89	1.00	1.00	1.00	1.00	1.13	1.00	1.00	1.13
14	0.66	0.88	0.74	1.00	1.00	1.00	0.73	0.85	0.86	1.05	0.98	0.98	1.07	1.03
15	1.00	1.00	1.00	0.82	0.92	0.90	0.78	0.81	0.95	0.88	0.97	0.90	0.98	0.85
16	0.98	1.00	0.98	0.81	0.83	0.98	1.00	1.00	1.00	1.01	0.96	1.00	1.01	0.98
17	0.59	0.91	0.65	0.71	0.82	0.86	0.97	0.97	1.00	1.28	1.00	1.03	1.25	1.28
18	0.95	1.00	0.95	0.87	0.92	0.94	1.00	1.00	1.00	1.03	1.05	1.00	1.03	1.07

19	0.54	0.91	0.59	1.00	1.00	1.00	1.00	1.00	1.00	1.36	1.03	1.05	1.30	1.41
20	0.94	0.94	1.00	0.48	1.00	0.48	0.94	0.94	1.00	1.00	0.97	1.00	1.00	0.97
Mean	0.80	0.94	0.85	0.68	0.90	0.75	0.81	0.95	0.85	1.01	1.00	1.01	1.01	1.01

	2000			**2004**			**2012**							
Rift valley	**CRS TE**	**VRS TE**	**SE**	**CRS TE**	**VR STE**	**SE**	**CR STE**	**VR STE**	**SE**	**Efficiency change**	**Technical efficiency change**	**scale efficiency change**	**pure technical efficiency**	**Total factor productivity**
1	0.73	0.95	0.76	0.76	0.77	0.98	0.70	0.92	0.76	0.98	20.16	0.99	1.00	19.77
2	1.00	1.00	1.00	0.74	1.00	0.74	0.57	0.88	0.65	0.76	4.56	0.94	0.81	3.45
3	0.80	0.86	0.93	1.00	1.00	1.00	1.00	1.00	1.00	1.12	22.56	1.08	1.04	25.23
4	0.66	0.76	0.87	0.68	0.96	0.71	0.61	0.93	0.65	0.96	18.90	1.11	0.87	18.15
5	0.92	0.93	0.99	0.50	0.88	0.57	0.99	1.00	0.99	1.04	18.18	1.04	1.00	18.84
6	0.91	1.00	0.91	0.70	0.92	0.77	0.86	0.89	0.96	0.97	17.38	0.95	1.03	16.87
7	0.93	0.98	0.95	0.58	0.84	0.69	0.91	0.91	1.00	0.99	23.30	0.97	1.03	23.14
8	0.86	0.90	0.95	0.57	0.83	0.69	0.80	0.99	0.80	0.96	20.20	1.05	0.92	19.47
9	0.70	1.00	0.70	1.00	1.00	1.00	0.95	1.00	0.95	1.16	17.48	1.00	1.16	20.34
10	0.76	0.85	0.90	1.00	1.00	1.00	1.00	1.00	1.00	1.15	15.95	1.09	1.06	18.31
11	0.60	0.72	0.83	0.61	0.75	0.82	0.71	0.83	0.86	1.09	18.29	1.07	1.01	19.88
12	0.83	0.95	0.88	0.72	0.94	0.76	0.60	0.84	0.71	0.85	16.59	0.94	0.90	14.05
13	0.83	0.88	0.95	1.00	1.00	1.00	0.57	0.87	0.65	0.83	13.63	1.00	0.83	11.30
14	0.84	0.92	0.92	0.54	0.86	0.63	0.81	0.81	1.00	0.98	19.67	0.94	1.04	19.32
15	1.00	1.00	1.00	0.61	0.87	0.70	0.70	0.89	0.79	0.84	17.36	0.94	0.89	14.53

16	1.00	1.00	1.00	0.84	0.91	0.93	0.61	0.83	0.73	0.78	0.00	0.91	0.86	0.00
17	0.82	0.91	0.90	0.38	0.78	0.48	0.93	0.93	1.00	1.07	21.17	1.01	1.05	22.60
18	1.00	1.00	1.00	0.67	0.82	0.82	0.55	1.00	0.55	0.74	15.70	1.00	0.74	11.67
19	0.89	0.89	0.99	0.47	0.85	0.56	0.72	1.00	0.72	0.90	20.11	1.06	0.85	18.14
20	1.00	1.00	1.00	0.80	0.80	1.00	0.63	0.91	0.69	0.79	15.77	0.96	0.83	12.52
21	0.98	1.00	0.98	0.60	0.82	0.73	0.86	0.91	0.94	0.93	17.93	0.95	0.98	16.75
22	0.87	0.88	0.99	0.49	0.69	0.71	1.00	1.00	1.00	1.07	23.51	1.06	1.01	25.20
23	0.96	0.98	0.98	1.00	1.00	1.00	0.97	1.00	0.97	1.00	18.16	1.01	0.99	18.24
24	0.89	1.00	0.89	0.77	0.88	0.87	0.72	0.93	0.78	0.90	16.59	0.96	0.93	14.91
25	0.76	1.00	0.76	0.71	0.83	0.86	0.74	0.93	0.80	0.99	16.85	0.96	1.03	16.71
26	1.00	1.00	1.00	0.84	1.00	0.84	0.70	0.95	0.73	0.84	13.85	0.98	0.86	11.58
27	1.00	1.00	1.00	0.61	0.91	0.67	0.94	0.94	1.00	0.97	15.44	0.97	1.00	15.00
28	0.95	0.97	0.98	0.69	0.85	0.81	1.00	1.00	1.00	1.03	17.88	1.02	1.01	18.37
mean	0.87	0.94	0.93	0.71	0.88	0.80	0.79	0.93	0.85	0.95	0.00	1.00	0.95	0.00

	2000			**2004**			**2012**							
Western	**CRSTE**	**VRSTE**	**SE**	**CRSTE**	**VRSTE**	**SE**	**CRSTE**	**VRSTE**	**SE**	**Efficiency change**	**Technical efficiency change**	**scale efficiency change**	**pure technical efficiency**	**Total factor productivity**
1	0.49	0.84	0.58	0.55	0.84	0.65	1.00	1.00	1.00	1.43	0.88	1.09	1.31	1.26
2	0.54	0.77	0.71	0.56	0.89	0.63	0.31	1.00	0.31	0.75	0.87	1.14	0.66	0.66
3	0.38	0.85	0.45	0.97	0.97	1.00	0.86	0.94	0.92	1501.00	0.95	1.06	1.42	1.42

4	0.58	0.92	0.63	0.53	0.97	0.55	0.96	1.00	0.96	1.29	0.76	1.04	1.24	0.98
5	0.25	0.92	0.28	0.79	0.89	0.89	0.91	0.99	0.92	1.90	0.82	1.04	1.82	1.56
6	0.37	1.00	0.37	0.61	0.99	0.62	0.43	0.78	0.54	1.08	0.84	0.89	1.22	0.90
7	0.68	0.79	0.86	0.66	0.94	0.70	0.88	1.00	0.88	1.14	0.81	1.12	1.01	0.92
8	0.69	0.88	0.78	0.98	1.00	0.98	1.00	1.00	1.00	1.21	0.85	1.07	1.13	1.02
9	0.67	1.00	0.67	0.84	0.90	0.93	0.95	0.97	0.99	1.20	0.85	0.98	1.22	1.01
10	0.44	0.90	0.49	1.00	1.00	1.00	0.42	0.86	0.48	0.97	0.72	0.98	0.99	0.70
11	0.67	0.99	0.68	0.63	0.93	0.68	0.55	0.92	0.60	0.91	0.88	0.97	0.94	0.79
12	1.00	1.00	1.00	0.57	0.88	0.65	0.83	0.91	0.92	0.91	0.80	0.95	0.96	0.73
13	0.51	0.88	0.59	1.00	1.00	1.00	1.00	1.00	1.00	1.40	0.78	1.07	1.31	1.08
14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.82	1.00	1.00	0.82
15	0.70	0.96	0.73	0.53	0.94	0.56	0.42	0.81	0.51	0.77	0.88	0.84	0.84	0.68
16	0.75	0.92	0.81	1.00	1.00	1.00	0.63	0.81	0.78	0.92	0.92	0.98	0.98	0.84
17	0.55	0.73	0.75	1.00	1.00	1.00	0.65	0.83	0.78	1.09	0.74	1.07	1.02	0.80
18	0.55	0.83	0.66	0.35	1.00	0.35	1.00	1.00	1.00	1.35	0.83	1.10	1.23	1.12
19	0.55	0.83	0.66	0.76	0.91	0.83	0.54	1.00	0.54	1.00	0.80	1.10	0.91	0.79
20	1.00	1.00	1.00	937.0 0	0.95	990. 49	0.97	1.00	0.97	0.99	0.71	1.00	0.99	0.70
Mean	0.62	0.90	0.69	0.76	0.95	0.80	0.77	0.94	0.81	1.11	0.82	1.02	1.08	0.91

Source: Authors Computation Based on SACMEQ Survey data, 2000; 2004; 2012

Table A7: Determinants of Efficiency

	2000			2004			2012		
Variables	**crste**	**vrste**	**se**	**crste**	**vrste**	**se**	**crste**	**vrste**	**se**
School characteristics									
Class-pupil ratio	-0.03(0.07)	-0.06(0.05)	-0.03(0.07)	0.01(0.1)	1.37(804.5)	0.02(0.03)	-25.48(16.92)	-41.6***(15.1)	6.05(14.2)
Pupil –toilet ratio	-0.01(0.01)	-0.01(01)	-0.03***(0.01)	0.01(0.0)	0.53(31.74)	0.00(0.01)	0.01(0.01)	0.01(0.01)	0.00(0.01)
Book-pupil ratio	0.25(0.31)	0.429*(0.25)	-0.19)0.31)	0.16(0.2)	-19.04(1901)	-0.30(0.22)	-0.06(0.22)	0.32*(0.17)	0.07(0.21)
School government allocation	0.00(0.0)	0.00(0.0)	0.00(0.0)	-7.16e-06*(0.0)	0.00(0.02)	0.00(0.0)	2.36e-06***(0)	0.00(0.0)	3.00e-06***(0.0)
Availability of playfield	0.51(0.72)	1.2**(0.57)	1.09(0.77)	1.44***(0.5)	1.9***(0.63)	1.36***(0.5)	1.93***(0.53)	0.76**(0.39)	1.6***(0.5)
No. of classes	0.28(0.24)	0.30*(0.17)	0.38(0.25)	0.46*(0.26)	21.69(1194)	0.47**(0.24)	0.33**(0.14)	-0.03(0.06)	0.6***(0.2)
Type of classes									
permanent classes	-0.38(0.4)	-	-0.61(0.43)	-0.01(0.11)	8.41(11)	0.24(0.17)	-0.11(0.13)	-0.06(0.06)	-0.12(0.11)

Temporary classes	-0.31(0.41)	0.479*(0.25) -0.48*(0.25)	-0.43(0.42)	-0.02(0.13)	4.37(915.9)	0.10(0.14)	0.00(0.15)	-0.20*(0.11)	-0.09(0.14)
Open classes	-0.24(0.51)	-0.37(0.34)	-0.34(0.56)	-0.24(0.15)	2.93(962)	0.09(0.25)	-0.54**(0.27)	-0.09(0.15)	0.12(0.25)
Total school possession	1.2e-05***(0.0)	0.00(0.0)	2.4e-05***(0.0)	-0.14(0.12)	15.01(614.9)	0.32**(0.16)	0.56**(0.22)	0.22(0.14)	0.35**(0.17)
School location									
Isolated	-2.52(1.6)	-0.55(1.19)	-4.97**(2.27)	0.39(5.56)					
Rural area	-0.72(0.96)	0.29(0.59)	-2.58*(1.38)	-0.68(3.47)	-79.75(0.0)	3.76(4.34)	-1.9(1.97)	2.128*(1.29)	-1.2(1.86)
Small town	-0.02(0.86)	0.991*(0.59)	-1.01(1.11)	-0.2(1.99)	-32.49(378)	1.44(2.34)	-0.64(2.01)	2.43**(1.15)	2.18(2.06)
Distance from dispensary	-0.09(0.07)	-0.08(0.06)	-0.09(0.07)	0.00(0.06)	-2.68(358.9)	-0.13(0.09)	-0.02(0.08)	0.07(0.06)	0.06(0.07)
Distance from main road	0.00(0.01)	0.00(0.01)	-0.01(0.01)	0.01(0.01)	0.17(39.2)	0.00(0.01)	-0.01(0.02)	-0.033**(0.02)	0.036**(0.02)
Distance from library	0.01(0.01)	0.01(0.01)	0.02(0.01)	0.00(0.01)	1.62(23.65)	0.023**(0.01)	-0.01(0.01)	-0.01(0.01)	-0.02**(0.01)

Distance from bookshop	-0.01(0.01)	0.00(0.01)	-0.02*(0.01)	0.01(0.01)	0.63(41.52)	0.05*(0.03)	0.037**(0.02)	0.01(0.02)	-0.01(0.01)
Distance from secondary school	0.02(0.04)	0.03(0.03)	-0.04*(0.02)	0.05*(0.03)	-0.06(223.3)	0.04(0.07)	0.08*(0.05)	0.13***(0.04)	-0.03(0.04)
Teacher post-secondary education	0.18(0.62)		0.38(0.73)	-0.29(0.2)	2.66(916)	0.11(0.19)	-0.16*(0.1)	-0.30**(0.12)	-0.5***(0.19)
Teacher characteristics									
Total teachers		-0.44(0.34)		-0.25(1.15)	-0.27(1.07)	-0.35(1.11)	-0.2(0.52)	1.14(1.62)	8.53**(3.44)
Female teachers	0.01(0.08)	-0.04(0.06)	0.11(0.09)	-0.01(0.03)	0.04(0.03)	-0.02(0.03)	0.13(0.14)	-0.02(0.1)	0.29**(0.15)
Teacher Experience									
No experience	0.18(0.61)	0.73*(0.39)	0.17(0.73)	-0.01(0.13)	2.87(24.97)	-0.97(1.82)	-0.43(0.55)	-1.34(1.64)	-9.5***(3.58)
0- 1 year	1.01(0.83)	1.9***(0.65)	1.65(1.09)				0.54(0.76)	-0.75(1.63)	-8.37**(3.45)
1 year	0.01(0.62)	0.72*(0.38)	-0.15(0.73)	-0.17(0.87)	67.63(29.80)	-0.56(-1.89)	0.01(0.5)	-1.09(1.62)	-8.9**(3.49)
1-2 years	-0.21(0.61)	0.53(0.4)	-0.29(0.73)	-0.65(1.01)	20.85(33.19)	-1.57(2.09)	0.3(0.68)	-1.14(1.68)	-8.73**(3.53

									)
More than 3 years		0.61(0.57)		-0.15(0.15)	-0.09(0.16)	-0.20(0.15)	-0.08(0.53)	-1.36(1.58)	-8.86**(3.47)
Teacher pupil ratio	0.07(0.08)	0.09**(0.05)	0.12(0.08)	0.07(0.07)	-1.25(509.3)	-0.11(0.07)	0.01(0.03)	0.05(0.03)	0.00(0.03)
Teachers age	-0.12(0.32)	0.35(0.26)	-0.49(0.32)	-0.29(0.45)	-99.34(1217)	-0.98(0.76)	0.01(0.05)	-0.01(0.04)	0.09**(0.04)
Teachers with primary school education	0.27(0.63)	0.03(0.07)	0.75(0.75)	1.02*(0.53)	-28.48(2232)	-0.20(0.54)	-0.66*(0.38)	-0.67*(0.36)	0.18(0.35)
Teachers with secondary school education	0.14(0.63)	0.00(0.05)	0.32(0.73)	0.05(0.32)	3031 (2499)	47.94***(1.8)	-0.27(0.53)	-0.6(-0.52)	-0.6(-0.54)
Teachers with professional qualification	0.54(0.66)	0.43(0.52)	0.66(0.73)	-0.05(0.32)	3019(2222)	47.69***(1.8)	-0.79*(1.86)	-0.26(0.03)	-0.78**(3.58)
No. of teaching years	0.03(0.06)	-0.087*(0.05)	0.06(0.06)				0.01(0.02)	0.01(0.01)	0.02(0.01)
Constant	2.09(1.77)	2.69*(1.47)	-0.04(1.95)	5.75(0.0)	482.6(0.0)	3.75(0.0)	-1.31(5.4)	3.25(4.0)	2.01(3.85)
Chi-Square	71.72	72.35	89.87	147.03	101.45	98.39	8894.00	115.26	115.53

LR Chi Square	71.72	72.35	89.87	147.03	101.45	98.39	88.94	115.26	115.53
Log Likelihood	-41.75	-62.93	-40.58	-7.56 e-07	-37.92	-27.85	-30.36	-37.44	-29.89
Prob>chi square	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pseudo R squared	0.46	0.37	0.53	1.00	0.57	0.64	0.59	0.61	0.66

Source: Authors Computation Based on SACMEQ Survey data; 2000; 2004; 2012*** p<0.01, ** p<0.05, * p<0.1; Standard errors in par