PUBLIC EXPENDITURE AND HEALTH STATUS

A CASE STUDY OF KENYA

BY

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DECLARATION

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

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This research paper has been submitted for examination with our approval as University supervisor

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DEDICATION

I wish to dedicate this work to my late father Pa Sorie Kargbo and my mother Mammy Haja Iye Sesay for they sacrificed a great deal to facilitate my education. I would also wish to dedicate this research paper to my daughter Mammy Iye Osayin Kargbo for her perseverance and understanding.

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LIST OF ABBREVIATIONS

ADF	Augumented Dickey-Fuller test
AIDS	Acquired Immuno-Deficiency Syndrome
AR	Autocorrelation test
ARCH	Autoregressive conditional heteroscedasticity test
ASWt	Access to safe water
DF	Dickey-Fuller test
ECM	Error Correction Mechanism
EEc	Education expenditure per capita
GDP	Gross Domestic Product
GNPpc	Gross National Product per capita
GOK	Government of Kenya
HC	Health care
HEc	Health expenditure per capita
HIV	Human Immuno-Deficiency Virus
IMR	Infant mortality rate
Ksh.	Kenya Shillings
LE	Life expectancy
MOH	Ministry of Health
NGO	Non-Governmental Organisation
NHIF	National Hospital Insurance Fund
NY	National Income
OLS	Ordinary Least Square
PHC	Primary health care
RESET	The regression specification test
U-5MR	Under-five mortality rate
UNDP	United Nation Development Programme
UNICEF	United Nations Children's Fund

ABSTRACT

This Research Paper investigates the impact of public expenditure and health status in Kenya over the period 1972-2000.The study estimates an aggregate and disaggregates health production function. The variables used are national income, education per capita, health expenditure per capita, access to safe water, life expectancy, Infant mortality rate and under-five mortality rate.

The study attributes low health status to insufficient public spending by the government of Kenya.The prime objective was to statistically test the nature and the significance of the relationship between health status and public expenditure.

The findings of the study indicate a strong contribution to health status by public health inputs such as access to safe water, health and education. The influence of services that are dependent on consumer demand is more difficult to identify both for preventive services, such as immunization and for curative medical care

Results findings show that several policy recommendation are established. With this regards the study recommends resources must be channeled towards primary and preventive health care. It recommends the government should stop directing more resources to defense because it has no direct effect on social welfare. The government should encourage the role of the local authorities in education, health and education sector should be clearly articulated.

CHAPTER ONE

1.1 BACKGROUND

1.1.1 Health Status in Kenya

Most governments strive to provide health care services to all the people even in the force of severe economic constraints but it is not clear whether governments spent money efficiently to increase utilization of health care services. There is a need to allocate the limited fiscal resources based on a clear understanding of how investments in the health sector affect the demand for health care services and how the changes in the pricing of public services and investments in quality improvement affect the health seeking behavior of consumers.

In developing countries, estimates of total health expenditure ranges from less than 1 % of GNP in the poorest countries to 5% of GNP in middle-income countries (Cuyler1989). The government's share of these expenditures may account between 30 and 70 percent. Per capita spending around the world varies from less than US$ 1 to more than US$ 800 (Catherine et. al., 1996).

According to WHO, the target for 2000 was to attain health levels that would permit people to live socially and economically productive lives. People must be healthy to contribute and share in social and economic development (Hoare, 1986). Despite the commitment by African governments to improve the health care systems, many still allocate a very small percentage of government expenditure on public health (Geoff, 1986). In some countries, the budgetary allocation to the health sector has been declining

when it is most needed to improve the health care delivery system. In other countries, health sector expenditure has been reduced by 59% or more, with a virtual cessation of the capital investments in the health sector (Commission on Health Research for Development, 1990).

According to Grossman (1972) more spending produces more health. Nevertheless, this presumption may be elusive if expenditure is not utilized properly. This depends among other things, on the allocation of expenditure between recurrent and development expenditures. In Kenya, for instance, over 70% of the Ministry of Health recurrent health budget are used to pay for staff salaries and allowances leaving only 30% for supplies and other expenses (National Development Plan, 1997-2000). In the fiscal year 1996/97, the allocation of expenditure to urban areas on curative care accounted for 67% of total recurrent expenditure while promotive and preventive health care accounted for 21%. Due to this inequality in budgetary allocation, the PHC facilities continue to experience inadequate supplies and under utilization of the dispensaries (National Development Plan, 1997-2000).

Between 1980-1997 period, public expenditures on health increased by an average rate of 5 percent per annum (see Nganda and Ong'lo, 1999). Since 1997, In absolute terms, nominal health care expenditures increased from Ksh. 1080 million in 1980 to Ksh. 9220 million in 1997, a nearly nine-fold increase. However, in real terms, the increase was only two fold with health care expenditures rising from Ksh. 1400 million in 1980 to Ksh. 3420 million in1997. As a proportion of real government budget, real public health

expenditures on health declined from about 10 percent in 1980 to just under 6 percent in 1997 (see Nganda and Ong'olo, 1999). Resources were also reallocated away from urban hospital-based curative services towards more PHC, with an emphasis on the rural population.

The inability to raise sufficient funds for financing health care is also partly due to the narrow tax base, which consists largely of indirect taxes such as customs duties, receipts from direct taxes such as income tax. In Kenya, like in most developing countries, the tax revenue is the major funds, and is a significant major determinant of overall public expenditure.

The secular decline in health expenditure has affected the ability of Kenya's public health sector to provide health care services. The share of government recurrent expenditure allocated to health was 9.6 percent in 1996/97 compared to 9.26 percent in 1979/80. However, expenditures were at there lowest in 1988/89 (7.35 percent) before rising steadily to about 8 per cent in 1994/95. The situation is likely to worsen in the face of severe economic constraints if appropriate measures are not taken. Per capita expenditures have steadily declined from a high of US$9.82 in 1980/81 to US$6.2 in 1995/96, which is a 36 per cent drop. This situation is likely to be aggravated by the HIV/AIDS pandemic (MOH, 1997).

1.1.2 Macro-Economic Health Situation

Kenya entered the 1970s with a strong economy exemplifying the excellent macro - economic performance of the 1960s. The economy has generally undergone mixed experiences since independence in 1963. Efforts have been made to improve the standard of living of her people and this aspiration has consistently been reflected in various government policy documents such as the sessional papers and development plans.

The macro-economic performance record of the economy during the 1960-1980 period was attributed to several factors including high savings and investment ratios, expansion of small holder production of cash crops, and favorable external environment. With these factors and the resultant 'golden' macro-economic performance record, the country's health sector recorded tremendous growth, especially in the public-sector. The sectoral growth was attributed to the high priority accorded to the improvement of the health status of Kenyans in the socio-economic development of the country. The priority was reflected in the level and growth of resource commitments to the health sector. During these decades, the sector accounted for 5% of GDP, and, on average, about 5% of total central government expenditure and 6% of the government's total recurrent vote.

The high growth rate during these decades resulted in a phenomenal growth in the number of health care facilities, programs and personnel, and in the improvement of the health status of Kenyans. Some progress was made during the first decades of independence as shown by the per capita incomes growing at 2.6% per year.

1.1.3 Health Status Situation

The basic health indicators show that Kenya has performed better than other East African countries in life expectancy, infant and maternal mortality rates in the last three decades. Human capital is one of the fundamental determinants of economic growth. Health status affects both the quality and quantity of this economic resource. Reduction of mortality rates increases the person days of economic activity available to the economy. A reduction of morbidity rates increases the number of days as well as the productivity of the workforce, and productivity improvement is a key factor in economic growth.

In Kenya life expectancy at birth (years) for male is 51.1 and that of female is 53 in1997. The life expectancy at birth improved from 39 years in the 1950-55 period to less than 60 years in the 1995-2000 period. The life expectancy for female has generally been higher than that of men (see Nganda, 1994).

Infant mortality rate (IMR) is measured as the number of deaths among infants less than one year of 1,000 live birth. Infant mortality over the years fell by just over one half. However, MOH has not been able to expand its health facilities as rapidly as the population to ensure adequate coverage, accessibility and provide health services of acceptable quality. Inadequate financial resources and the inefficient utilization of existing resources and/or the emergence of new diseases have exacerbated this situation. Infant mortality dropped from 170 per 1000 to 60 between 1962 and 1994, and the immunization coverage rose to 70% from less than 40% at independence in 1963 (8^{th} National Development Plan, 1997-2001).

1.1.4 Expenditure Allocation patterns

The government remains the major financier of health care, meeting nearly half of the national health recurrent expenditure. The private market (insurance and out of pocket modes) meets 42%, while the missions, companies, donors and NGOs meet 6% of the expenditure (WHO 1995). In creating and supporting the expanded health infrastructure the GoK relied heavily on tax revenues, leading to a rapid growth in the nominal health budget from Ksh. 2554 million in 1972 to Ksh. 13820 million in 1996, out of which the recurrent component accounted for about 80% (GOK, 1999). The increases in nominal funding evident, MoH's total and recurrent spending as a percentage of treasury budget allocations have been on the decline from the early 1980s. This coincided with the implementation of structural adjustment programs. Similarly, MoH's spending per capita, that rose in the 1970s declined after 1980.

In terms of resources allocation, there are two central issues regarding the distribution of resources between curative and preventive health care; and the allocation of expenditure between urban and rural areas. With respect to distribution, curative care accounted for 67% of total recurrent expenditure for 1996/97 while rural and preventive health care accounted for 21%. This expenditure mix discriminates against rural and poor populations. With respect to the allocations of expenditure, the Kenyatta National Hospital accounted for 16.3% of total recurrent expenditure, while all rural health centres, the first constant for rural populations accounted for 21%. Hence, health expenditures tend to favour the urban areas. However, the effect of the inequality in

expenditure allocation indicated that if expenditure increases this shows that infant mortality rate and under-five mortality rate reduces as well as life expectancy improve

The National Hospital Insurance Fund (NHIF), established in 1966, provides another financing mechanism to Kenya's health sector. The scheme provides cover for the contributors (mostly standard people) and their families, for in-patient care in approved hospitals. The fund provides about 50% of the cost-sharing revenue and has, until recently, provided a major source of income for many hospitals. The performance of the NHIF has been improving. The total number of contributors to the Fund rose by 12.5% from 1.6million in 1994/95 to 1.8million in 1995/96. Similarly receipts from contributors' rose by 17% from Ksh. 1228.8 million in 1994/95 to Ksh. 1438 million in 1995/6

Table 1.1: Trends in the Allocation of Expenditure by sector 1980-1997 (%)

Year	Public adm.	Defence	Education	Health	Social services	Economic affairs & services	Total
1980	19	23	27	9	3	19	100
1981	20	15	29	9	3	23	100
1982	20	19	28	9	3	20	100
1983	17	20	30	10	3	21	100
1984	19	18	30	9	3	21	100
1985	20	13	30	9	3	25	100
1986	18	13	35	9	3	22	100
1987	18	13	33	9	3	25	100
1988	19	18	35	8	3	17	100
1989	22	13	36	9	3	18	100
1990	20	16	35	8	3	18	100
1991	21	15	36	8	3	18	100
1992	22	11	34	8	2	24	100
1993	23	11	43	8	2	13	100
1994	23	11	43	8	2	13	100
1995	25	8	41	8	2	15	100
1996	27	10	36	9	2	16	100
1997	28	11	33	8	2	19	100

Source:Statistical Abstracts, various issue (years)

As shown in table 1.1 above the allocation to the health sector declined marginally from 9 per cent in 1980 to 8 percent in 1997. In the case of administration increased from 19 per cent in 1980 to 28 per cent ion 1997 showing that the expenditure pattern improved gradually. With respect to education expenditure from 27 percent in 1980 to 33 percent in 1997. Expenditure on defence declined from 23 percent in 1980 to 11 percent in 1997.

1.2 STATEMENT OF THE PROBLEM

Since independence in 1963, the Kenya Government has continued to design and implement policies aimed at improving the country's health status. This was in line with the universal declaration that emphasized among other things the need to achieve "Health for All by the year 2000". Given the close association between health expenditure and health status, there are fears that, the decline in expenditure allocation to the health sector might lead to worsening health status.

Moreover with the existing inequalities in expenditure patterns, the health status of the population might decline. Because of the disparity in Kenya's efforts towards enhancing health status will be an elusive goal and targets on key health indicators such as life expectancy, mortality rate and under 5-mortality rate may not be realized. The situation is likely to worsen given that the country's expenditure is biased towards the urban areas, yet 70% of Kenya's population live in the rural area. Furthermore, deterioration of the health status of the Kenyan population might worsen due to emergence of old and new diseases such as HIV/AIDS, and inefficient health care system. Thus, although expenditure on health is accorded a central place in the MoH policies, there are few or no

studies that have been done to determine the effect of public expenditure on health and health status. This study aims to bridge this knowledge gap.

1.3 OBJECTIVES OF THE STUDY

The overall aim of the study is to investigate the nature of health expenditure patterns and its impact on health status in Kenya. The specific objectives are to:

1. Empirically estimate the impact of public expenditure on health status in Kenya
2. Draw policy recommendations based on empirical findings of the study.

1.4 JUSTIFICATION OF THE STUDY

The outcome of this study will help policy makers to design, implement and monitor expenditure policies with a view to improving health status. In addition the findings of the study will help policy makers and planers to determine which health policy is appropriate in improving the health status in Kenya. In the case of the Ministry of Finance the findings will help in identifying the funding gaps. The results will thus, enable the Ministry of Finance to examine ways of reallocating financial resources so as to bridge the gap between the poor and the non-poor. To the Non- Governmental Organizations, donors, and other partners in health care financing, the study will provide useful information that could help them to specify which health care system

The findings of this study will be useful to MoH planers and policy makers in that, they can be able to identify which of the health indicator is deficient or efficient. This is necessary to enable them carry out the overall improvement in the health status of the people of Kenya. Government can use the findings to put in place policies that will cater for the poor and improve their accessibility to medical services.

CHAPTER TWO

2.0 LITERATURE REVIEW

This chapter summarizes both the theoretical and empirical literature on health in terms of its relationship with health status and public expenditure.

2.1 THEORETICAL LITERATURE

Abel Smith (1963) carried out a study on health care services and sources of revenue in six countries from Western Europe and North America. Health care expenditure was associated with reduced life expectancy and increased infant mortality. In a similar study involving 29 countries, Abel Smith (1967) found that the level of national income were associated with improved health status and that the demand for health care increased in countries with declining mortality. Abel Smith's studies laid down foundation for the development of methodologies for tracking health expenditures in both private and public sectors.

Carrin (1988) argues that health status in Sub-Saharan Africa is still a far cry goal of health for all. He argued that there is general constraint on public sector budgets and the situation is exacerbated because health has to compete for resources with defense, education and housing. In an effort to lessen the restrictions on health development caused by limited public health budgets, he suggests alternative methods of health financing, including health insurance; foreign aid; raising taxes; reallocation of public

resources or cost-recovery scheme (user fee). He however notes that although cost-recovery scheme can be operated nationally, the administrative cost may be excessive.

On the other hand, Cochrane et al 1978 show that provincial differences in geographical areas as well as relative density might also affect access to health care despite similar per capita spending. Greater density might lead-in general, to lower unit price of health. This in turn will lead to greater care for a given level of spending and therefore greater life expectancies and lower infant mortalities, *ceteris paribus*.

Why is public spending on health ineffective at improving health status even though relatively cheap and effective medical interventions exists? Addressing this questions (Filmer et al, 1997) suggests two likely explanations: (1) cross national differences in the public spending on health does not always translate into a larger supply of effective health services. (2) Public monies are spent on expensive, but ineffective, curative services.

2.2 EMPIRICAL LITERATURE.

Murray et al (1993) carried out a study on the impact of "Global Domestic Expenditures on Health" by categorizing the expenditure into public sector expenditures and private sector expenditures. Public sector expenditure comprised of government and parastatal expenditures on health and private expenditure including private voluntary and household spending. The study further found out that public health expenditure accounted for 44% in Africa. Capital expenditure accounted for about 17% of the total government health expenditures.

Bidain and Ravallion (1997) estimated the relationship between the level of life expectancy and infant mortality using a multivariate regression that explains health outcomes without any health sector variables. The use of this specification allows separation of the impact of various variables on the poor and non-poor. They consistently find an impact of public spending for the poor but not for the non-poor. Their findings are still consistent with impact of spending on aggregate health status. Their findings highlight the importance of benefit the poor, so a reductions without reallocation of resources would affect the poor. The impact on the poor versus the non-poor will also not be a constant or immutable parameter, but will depend on the composition and efficacy of public spending. They estimate a multivariate regression that explains health outcomes without any health sector variables.

Caldwell et al (1986) in his paper routes to low mortality in poor countries, examined cross-national differences in the widest and best-measured indicator of health status, child (under 5) and infant mortality. He established two major points about the cross-national relationship between health status and public spending on health. First, there is an enormous gap between the apparent potential of public spending to improve health status and the actual performance. Second while public spending appears to explain little differences across countries in infant and child mortality are well explained by economic and social factors. The further notes that there are poor countries with exceptionally good health status, outcomes and leaves little to be explained by independent variation in health policy. He included a dummy and hypothesizes that these countries will have

higher mortality. He further argues that both aggregate and household size show that higher levels of female education are associated with better health status.

Jamison et al (1996) used an econometric procedure to estimate the under 5 mortality. He found that public spending on health lowered mortality, in a sample of Latin America countries. They found a positive and significant impact of public spending on health status.

Manyalla (2000) argued that expenditures on education and health care improve health status. He further noted that per capita income is significantly linked to the levels of mortalities. He found out a per capita income elasticity that was quite large statistically significant. He observed that some of the negative trends in health status could have been attributed to unfavorable growth and insufficient social spending on health. In his findings income elasticities were all statistically significant, current income had the expected effect on life expectancy but not on infant mortality. He further found that if mothers are malnourished and are in poor state of health, their infant will inherit part of this poor health, and therefore will be at greater risk of mortality relative to infants of healthy mother.

Nganda and Ong'olo (1999) carried out an analysis of government expenditure on basic social services in Kenya The objectives of the study were to determine how much of the National budget and international aids flows being spent on basic social services (BSS), and the financial implications for basic social services in improving health status. They

attributed the decline of public expenditure to the improved health services especially the increased emphasis on immunization (for childhood diseases). Life expectancy at birth also improved from 39 years in 1950-55 to over 60 in the 1993.They found that the proportion of health care spending on health care as a share of real GDP had been falling. The results further revealed that only 10% of the government budget in the recent times go to development activities while the rest goes to recurrent items. These results revealed a decline in the infant mortality rate and this attributed its improvement to the increase in expenditures on health.

Schultz (1999) did a study on health and schooling Investments in Africa. He argues that health status will rise with increased public spending on health services. He further notes that it will fall with a rise in relative prices of health inputs such as salaries of medical personnel, cost of drugs and other medical supplies, relative to prices of nutrients that help fight off infections and disease. He found higher levels of education are correlated with lower mortality, even after holding household income constant. The relationship between mothers' education and mortality rate was stronger than the fathers', which could be explained by the fact that mothers are more often in charge of child care than the fathers. He observes that an additional year of schooling to the mother in low-income countries such as Africa is often associated with a 5-10 percent reduction in the child's likelihood of dying in the first five years.

Hitris and Posnett (1992) in their study on the determinants and effects of health expenditure in developed countries. They note that a reduction in health care spending is

associated with reduced life expectancy for both female and male and increased death rates among children less than a year old. They note that improved health outcome is important because it has been so difficult to identify in research. They find very limited evidence of a relationship between health care expenditures and mortality rates. Argue that few studies have find strong link between health care spending and some measure of quality of life expectancy. Despite great care in this study including a large pooled time series and cross-section analysis with econometric corrections for heteroshedasticity and autocorrelation, it suffers from the inherent heterogeneity associated with cross-country studies. Pritchett and summers (1996) using instrumental variables and fixed effects estimation on a panel of data find that those who are wealthy are causally healthy for the cases of infant mortality, under-5 mortality, and life expectancy.

Nganda (1994) examines the trends in public expenditure in Kenya. He specifically examined the correlation between real GNP per capita and the health indices, (life expectancy (LE), infant mortality rate (IMR), Under-5 mortality (U5MR) and morbidity). He estimated the following model.

$$\text{Ln HCEpc} = \alpha + \beta \text{ lnGNPpc, with } \beta>0$$

Where ln is the natural logarithm, HCEpc is health care expenditure per capita, GNPpc is the Gross National Product per capita, α and β are parameters, to be estimated

The coefficient of log of Gross National Product per capita (lnGNPpc) can be interpreted as the elasticity of health care expenditure per capita with respect to Gross National Product per capita (GNPpc). He notes that per capita income is only one aspect of welfare others being security, freedom, longevity, health status, literacy and nutrition. He argues that health status is the most frequently used non-monetary indicator of a country's development performance. It can be approximated by various measures such as life expectancy at birth or infant mortality. He found a positive relationship between GNP per capita and per capita spending on health status.

He also compared the relationship between GNP per capita and the health status indices, which includes Life expectancy, infant mortality rate and under-5-mortality in developing countries. This was done empirically by estimating the equation below.

$LnLEY=\alpha+\beta lnGNPpc$, with $\beta>0$

Where LEY^{89} is life expectancy in years at birth in 1989. He found that for every percentage increase in Gross National Product per capita, life expectancy increased by 0.13 percent. He notes that due to central role of health status as a measure of a country's health policies, most governments play an important role in providing health care services and/or in financing it. The findings reveal that the proportion of state governments'budget allocated to the health sector was not correlated with the level of GNP per capita. Health spending per capita was however correlated with health.

Filmer et al (1999) estimated a multivariate regression that explains country health outcomes with socioeconomic characteristic and public expenditure. For infant mortality, they found that the elasticity at the population-weighted means was -0.213 for the poor and -0.056 for the non-poor, which is roughly comparable to their estimated elasticity-0.078 in the aggregate.

George et al (1997) observes that global spending on health amounted to about $2.3trillion in 1994, or about 9% of total global income. High-income countries spent just over $2 trillion, amounting to 89% of total health expenditure, while their populations account for 16% of the global population. Developing countries, with 84% of the world population account for only 11% of all health spending. This disparity underscores the enormous difference between developed and developing countries in terms of capacities and types of health services that can be provided. This translates into large difference in health infrastructures and health.

2.3 SUMMARY OF THE LITERATURE

Based on the literature review many issues have been shown to explain the impact of public expenditure on health status. Real GDP per capita, education, access to safe water, public share in health spending and the share of public spending on health in GDP are major variables that have been found to determine the health status. The more a country spends in health the higher the health status. Empirical studies reviewed have used different methodologies and variables to establish the fact that increased public

expenditure reduce mortality and improve life expectancy. The studies used these different approaches because of the nature of the problems they sought to address.

On the other hand, public expenditure and health expenditure, are statistically significant in determining public expenditure and health status. However, no specific results have been achieved, nevertheless it is difficult to confirm that public expenditure and health status have a negative impact on health. Non economic variables considered in the different studies have shown some consistence with what economic theory predicts.

Most of the studies are cross national. One of the potential methodological problems with most of these studies is that, it is never clearly specified whether private expenditure is significant in determining the improvement in health status. Most of the studies reviewed in Kenya are confined to the impact of GNP per capita on health status.

However, another major study shows that the government relied heavily on tax revenue. Another study shows the trends of health spending in Kenya since 1972-1999. Another study shows the impact of this expenditure on health status and made conclusion that infant mortality had decline considerably.

However, major shortcoming of the studies reviewed is that the results of these studies have differed in several ways. Most of the studies reviewed have found a statistically insignificant positive relationship between public expenditures and health status. Out of

the several studies that considered national income, only few found that there is a positive and statistically significant relationship between public spending and health status.

Most of the studies have a major weakness that they never show any of the health effects of these expenditures. However, this study will fill the knowledge gap by providing precise information of the relationship between public expenditures and health status. It is important to note that, expenditures on health such as water and sanitation, education, nutrition, housing and personal habits have greater impact on health status indicator.

This study is intended to make comparison between its results and the results of other similar studies done before especially Manyala (2000).

CHAPTER THREE

3.0 THEORETICAL FRAMEWORK AND METHODOLOGY

The consumption of medical goods improve the health status which in turn procures utility (Phelps, 1995). The demand for health care is a derived demand. The desire for health leads to the search for health care services that are used for producing health.

Phelps further observes that the process of transforming health-care services into health can be assimilated into a process similar to that of the production of meat, energy heat and so on. In economics the process is called the production function. It gives relationship between inputs (factors of production) and output. More health care produces more health and the marginal productivity of health care is positive. It can also be assumed that the incremental effect of health care diminishes as soon as one receives it.

Based on the above the individual possesses a stock of health at a given moment. This stock of health or the flow of services coming from this stock of health creates a flow of utility. When the stock of health deteriorates following a sickness the individual concerned with restoring his/her health will buy health services if he hopes that these services will improve his health status; in other words, if their productivity is positive.

According to Gertler et al (1990), the benefit obtained from the consumption of the health-care services is an improvement of the health and the cost of obtaining health care is a reduction in the consumption of the other goods and services. The individual is able to choose between numbers of alternatives from health care suppliers, among which is

safe care. Each supplier provides medical care according to cost. The cost of this alternative is composed of direct cost (consultation fees drugs, etc) and the indirect cost such as transport and opportunity cost of time when going to the health services. We assume that the quality of a health-care defined by the expected improvement of the health status is given by these health care services. Health is a highly valued asset, health is not everything in life but life without health is nothing, health is a prerequisite for other activities. Health is regarded as both consumption good and an investment good, as consumption good, health is desired because it makes people feel better. Health has value in-use but not in-exchange (not tradable). Health care is consumed in order to improve health (Grossman, 1972).

Health status can be measured using a number of per capita healthy days of the population, reciprocal of mortality rates, disability days and so on. Better nutrition, clean water hygiene, sanitation and family planning might have at least as important role to play as medical interventions. Primary health care e.g. immunization may be more important than secondary care in improving the health of the population as measured by life expectancy. An individual therefore derives utility from consuming health care. Using the above information, we specify the relationship between utility and other explanatory factors.

The behavioral model is based on Gertler and Van Der Gaag. It assumes that individual utility is a function of health and the consumption of non-medical goods. Individuals aim

at maximizing the utility. Formally, let the expected utility conditional on receiving health-care from provider j be given by

$U_j = U(H_j, C_j)$.....(1)

Where, H_j is the expected health status after receiving treatment from provider j

C_j is consumption net of obtaining care from provider j.

The medical care purchased from provider j is invested in health. The quality of provider j's medical care is defined as the expected improvement in health over the health status that an individual would enjoy if he or she treated him or herself. In essence, quality is defined as an expected marginal product. Let H_o be the expected health status without professional medical care (with self-treatment). Then the quality of provider j's care is $Q_j = H_j - H_o$, which yields an expected health care production function of the form.

$H_j = f(Q_j, H_o)$.....(2)

As specified in equation (2) quality varies by provider and may in fact also vary by individual characteristics such as severity of illness and the educational attainment, age and sex of the individual.

In this study, we make the assumption that the individual is also a producer of H_j. We argue that individual enhances his/her health status in the utility function from the following household production function:

$$HS_t = k(H_j, H_o, SS, HS_{t-1}) \quad \ldots\ldots(3)$$

Where, HS_t is the health status at time t;

H_j is quality of health provider j;

H_o is quality of self-treatment;

SS is a vector of social-economic variables and social services;

HS_{t-1} is a lag of health status (health status at time t-1).

Health is a productive good that produces health status. The greater one's stock of health the greater the number of healthy days. Equation (3) describes health status of an individual. To obtain the health status of the entire population, we assume that individuals across the country are maximizing the same utility function. That is, their demands for health care are driven by the benefits they derive from healthy days, that is, the need to produce healthy time to participate in the labor market and other non-market activities.

The implication here is that when a nation's health status improves utility across individual increases. We take this assumption to be consistent with the entire population's objective. It is said to be consistent with the actual health-seeking behavior of every individual, for example, when health status falls individuals spend their

resources towards health status restoration.

3.1 EMPIRICAL MODEL

Since our main interest is health status of the population we are going to specify and estimate a simple form of health production function model. The model is a derivative of our theoretical framework specified before. The reason for this is that individuals health status is assumed to depend on the changes in the explanatory variables given. As a result, therefore, health status is a function of national income and expenditure on vector of education and health. The health status model is expressed as follows: -

$$HS = f(NY, EHC) \quad \ldots\ldots(4)$$

Where; HS is the health status and includes under -5 mortality rate, infant mortality rate and life expectancy;

NY is national income;

EHC is a vector of education and health.

We disaggregate components, which make up the education and health expenditure into education (EC), health care (HC), and access to safe water (ASWC). Education and health expenditures are disaggregated further by classifying them as recurrent and development expenditures. The expenditure on education is included because more educated individuals are assumed to be capable of applying the health care standards better. The study uses the percentage population with access to safe water as opposed to other studies that use expenditure on water and sanitation. This is assumed to be a better explanatory variable of the health status as it captures the actual beneficiaries of the

expenditure on water and sanitation. Based on this assumption, our health status model takes the following form:

$$\ln(U5M) = \alpha_0 + \alpha_1 \ln(NYc) + \alpha_2 \ln(EEc) + \alpha_3 \ln(HEc) + \alpha_4 \ln(ASWt) + \eta \quad \ldots\ldots(5)$$

$$\ln(IMR) = \alpha_0 + \alpha_1 \ln(NYc) + \alpha_2 \ln(EEc) + \alpha_3 \ln(HEc) + \alpha_4 \ln(ASWt) + \iota \quad \ldots\ldots(6)$$

$$\ln(LE) = \alpha_0 + \alpha_1 \ln(NYc) + \alpha_2 \ln(EEc) + \alpha_3 \ln(HEc) + \alpha_4 \ln(ASWt) + \varphi \quad \ldots\ldots(7)$$

Where, lnNYc = log of national income per capita

lnEEc = log of education expenditure per capita

lnHEc = log of health expenditure per capita

lnASWt = log of percentage population with access to safe water.

lnU5MR = log of under five mortality rate

lnIMR = log of infant mortality rate

lnLE = log of life expectancy

α_0-α_4, β_0-β_4, χ_0-χ_4 = parameters to be estimated

η, ι, φ = error terms.

The postulated health status functions are adopted from the work of Manyala (2000). We have made slight modifications to Manyala's model by including the percentage population with access to safe water. Manyala's study used expenditure on water and sanitation. This study focuses on the total expenditures whereas Manyala looks at the basic expenditures on social services. The health expenditure is disaggregated into

recurrent and development. We estimate a disaggregated log linear model as stated below:

$$Ln(U5MR) = \alpha_0 + \alpha_1 \ln(NY) + \alpha_2 \ln(REEc) + \alpha_3 \ln(DEEc) + \alpha_4 \ln(RHEc) + \alpha_5 \ln(DHEc) + \alpha_6 \ln(ASWt) + q \quad \ldots\ldots(9)$$

$$\ln(IMR) = \beta_0 + \beta_1 \ln(NY) + \beta_2 \ln(REEc) + \beta_3 \ln(DEEc) + \beta_4 \ln(RHEc) + \beta_5 \ln(DHEc) + \beta_6 \ln(ASWt) + r \quad \ldots\ldots(10)$$

$$\ln(LE) = \chi_0 + \chi_1 \ln(NY) + \chi_2 \ln(REEc) + \chi_3 \ln(DEEc) + \chi_4 \ln(RHEc) + \chi_5 \ln(DHEc) + \chi_6 \ln(ASWt) + s \quad \ldots\ldots(11)$$

Where; lnREEc = log of per capita recurrent expenditure on education

lnDEEc = log of per capita development expenditure on education

lnREHc = log of per capita recurrent expenditure on health care

lnDEHc = log of per capita development expenditure on health care

lnASWt = log of percentage population with access to safe water

α_0-α_6, β_0-β_6, χ_0-χ_6 = parameters to be estimated

q, r, s = error terms in the equations.

3.2 THE HYPOTHESES.

In estimating equations (5) to (11), it is expected that the explanatory variables will influence the dependent variable in the following ways.

Table 3.1

Dependent Variable	Explanatory Variable	Expected sign
Log(Under-5 mortality rate)	Log (National income)	Negative (-)
	Log(Education expenditure)	Negative (-)
	Log (Health expenditure)	Negative (-)
	Log (Access to safe water)	Negative (-)
Log(Infant mortality rate)	Log (National income)	Negative (-)
	Log (Education expenditure)	Negative (-)
	Log (Health expenditure)	Negative (-)
	Log (Access to safe water)	Negative (-)
Log (Life expectancy)	Log (National income)	Positive (+)
	Log (Education expenditure)	Positive (+)
	Log (Health expenditure)	Positive (+)
	Log (Access to safe water)	Positive (+)

3.3 ESTIMATION PROCEDURES

The models specified in equations (5) to (11) were estimated by applying double-logarithm regression analysis on time series data. The equations were estimated using Ordinary Least Square regression (OLS). The econometric package used in the estimation of the model is the PC-give program.

3.3.1 Univariate Data Analysis

Hamilton, 1992 states that the univariate data analysis are done with the aim of identifying data points that are potentially difficult. However, the test for normality is done to ensure that the series follow normality distribution.

3.3.2 Unit root analysis

Unit root tests are performed on each variable using the Dickey-Fuller test and Augmented Dickey-Fuller tests as suggested by (Engle and Granger, 1987). Regression non-stationary variables increase the chances of spurious regression (Granger and Newbold, 1994).

3.3.3 Cointegration Analysis

The model was subjected to cointegration test in order to ascertain whether there is a stable long run relationship between the dependent variable and its regressors. This test is basically required to guard against loss of information relating to possible long run relationship in a model specified in the first differences. Testing for cointegration involves using the Engle-Granger (1987) two-steps procedure due to its simplicity. Other cointegration test procedures exist which are infact superior to the Engle-Granger procedures. However, they were not explored in this study. Instead, we employed the Engle-Granger procedures testing for unit roots. Cointegration test is done to determine if there is a long -run equilibrium relationship among the variables or not. The long-run relationship among the levels of the variable is restated through the error correction mechanism. In testing for Cointegration, we used the DF and ADF test from the

cointegrating regression. An error correction mechanism (ECM) is necessary to ensure a systematic disequilibrium adjustment process through which the dependent and explanatory variables are prevented from shifting away from their mean values.

3.4 DATA TYPES AND SOURCES

This study employed secondary time series annual data covering the period 1972-1999. This period was preferred because most data relevant for this study were not available prior to 1972. Most of the data were collected from the Government of Kenya official documents such as Economic Surveys and Statistical Abstracts.

The budgetary data was obtained from the Ministry of Finance (Annual Recurrent and Development Expenditure Estimates) and was supplemented by the annual budget reports. Other sources included Central Bank of Kenya publications, World Bank Reports, Government Finance Statistic year books, WHO, UNICEF publications the United Nations Statistical Divisions, UNDP annual Development reports and the Ministry of Health.

Annual data was collected on the following variables: National income per capita, Education expenditure per capita, Health expenditure per capita, Access to safe water per capita, under-five mortality, infant mortality and life expectancy.

3.4.1 Description of variables used

- National income per capita is Gross national income plus taxes less duties, subsidies and net primary income from non-resident sources divided by mid year population.
- Education expenditure per capita is the recurrent capita expenditure by government on education.
- Health expenditure per capita consists of recurrent and capital spending from government (central and local) budget and social (or compulsory) health insurance funds.
- Access to safe water is the availability of at least 20 litres per person per a source within one kilometer of the user's dwelling.
- Life expectancy at birth is the number of years a new born infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.
- Infant mortality rate is the number of infants dying before reaching the age of one year, per 1,000 live births in a given year.
- Under-five mortality rate is the probability that a new baby will die before reaching age five, if subject to current age-specific mortality rates.

3.4.2 Summary Statistics of the variables used

The summary statistics of the variables described above are presented in table 3.2 below.

Table 3.2

Variable	Minimum	Maximum	Average	Std. Dev.
LE	51.000	60.000	56.518	2.764
IMR	51.000	98.000	76.679	13.882
U5M	74.000	130.000	107.286	16.822
Y/N	180.000	550.000	322.500	81.312
HE	255460.000	13500900.000	3992319.310	4038770.833
EE	807460.000	50738600.000	14828980.000	15994610.735
ASWt	17.000	53.000	33.714	11.958

Where; LE = life expectancy;

IMR = Infant mortality rate;

U5MR =Under-five mortality rate;

Y/N = per capita income;

HE = health expenditure per capita;

EE = education expenditure per capita;

ASWt = access to safe water.

CHAPTER FOUR

4.0 ANALYSIS OF RESULTS

In this chapter we report the model estimation results. We first undertake the test for normality, stationarity tests and cointegration analysis, before finally presenting the OLS estimation test results.

4.1 NORMALITY TESTS

The common test that is used is skewness-kurtosis (Jarque-Bera) test which utilizes the mean based coefficients of skewness and kurtosis to check the normality of data all. In this study, the essential test statistic has a chi-square distribution.

Normality of the variables was done using the graphic analysis (eyeballing econometrics) and the more formal Jarque-Bera normality test. Normality graphical analysis is presented in the appendix (frequency distribution of data). Based on the graphs it is evident that they are normally distributed apart from the log of access to safe water. The frequency distribution graphs clearly show that all the variables are normally distributed. The normality tests results done using the Jarque-Bera test are presented in table 4.1 below.

Table 4.1: normality test

Variable	Mean	Std. Dev	Skewness	Excess Kurtosis	Normality Chi sq	Normality prob
LIM	4.322338	0.18868	-0.425789	-0.831743	2.7663	0.2508
LY/N	5.743748	0.257974	-0.339749	0.192851	1.6656	0.4348
LLE	4.033337	0.049638	-0.58708	-0.95894	7.6349	0.0220
LU5M	4.655719	0.170054	-0.73615	-0.77048	6.8715	0.0322
LASWt	3.456454	0.350135	0.105476	-0.844457	0.49954	0.7790
LHER	7.448581	1.115485	-0.124773	-0.927592	0.8561	0.6518
LHED	6.070300	1.387027	0.457345	-0.656609	2.2018	0.3326
LEED	6.068070	1.120113	-0.295012	-1.138905	3.5846	0.1666
LEER	8.782901	1.242501	-0.013773	-1.122822	1.7306	0.4209
LHE/n	-2.27423	0.821185	-0.02337	-0.74904	0.16348	0.9215
LEE/n	-1.06936	0.927426	0.055342	-0.97712	0.90901	0.6348

The normality probability value is the probability of committing a type 1 error by rejecting the null hypothesis of normality when it is indeed true. Since none of the probability is less than the 5% level of significance, the null hypothesis of normality cannot be rejected. This means that all the variables are normally distributed.

4.2 DATA STATIONARITY

Regression results only make sense if stationary data is used. Therefore, the first task of the study was to ascertain whether the data for use was stationary or not. This is extremely important when using time series macro-economic data, which are known to be non-stationary in many cases. If used in their non-stationary form, time series data yield "spurious" results and thus lead to conclusion whose validity is questionable.

Stationarity is a situation where the probability distributions of the process are unchanged if displaced in time. Non-stationary series (process) have exactly the opposite of the above conditions. Stationary series have a finite variance. Moreover, they have a

tendency to go back to their average value. In contrast to this, the non-stationary series have variance, which is infinite, and do not often cross the mean. For such series any changes (innovations) to the series become permanent.

In order to use non-stationary data, the first task was to find the level of differencing at which such a series were stationary. If a series is 'd ' times in order to obtain stationarity then this is referred to as integrated of order "d" and is denoted by Y(d). The value in the brackets refers to the number of times a series is differenced to obtain stationary. Hence I(1) series is differenced once while a I(0) series is not differenced.

Based on the graphical analysis, see appendix all the graphs are not mean reverting, in this regards are non-stationary. This is an indication that the variables are integrated. However, the level of integration is not known. This calls for a more formal test. Furthermore, the graphical analysis alone cannot fully identify the order of integration of the variables and therefore we undertake the unit root tests.

4.3 UNIT ROOT TESTS

The first stage is to test whether the variables are stationary, or test the level of integration through the unit root tests. The simplest case of this test comes from random walk variables specified by equation (1) below. That is a variable that assumes the same value as in the last period, modified by current shocks.

$$X_t = X_{t-1} + \varepsilon_t \quad \ldots\ldots(1)$$

Where ε_t are shocks to the system and are assumed to be a white noise process with zero mean, constant variance and non-autocorrelated. In general we can write equation (1) as

$X_t = \alpha X_{t-1} + \varepsilon_t$ .....(2)

In equation (2) we observe the value of the coefficient (X_{t-1}) and test the null hypothesis Ho: $\alpha = 1$ against the alternative that $\alpha < 1$. Accepting the null hypothesis implies that the variable has a unit root or is a random walk variable, stating that the variable is a non-stationary. Nevertheless, if $\alpha<1$, then the process generating X_t is integrated of order zero and hence stationary. We shall use the Dickey-Fuller test (DF) and the Augmented Dickey- Fuller test (ADF) to test for unit roots.

4.3.1 The Dickey- Fuller (DF) Test

This test is based on the following equation,

$\Delta X_t = \phi X_{t-1} + \varepsilon_t$ .....(3)

This equation can also be rewritten to resemble equation 2 as follows

$X_t = (1 + \phi) X_{t-1} + \varepsilon_t$ .....(4)

Thus $\alpha = (1 + \phi)$ or $\alpha - 1 = \phi$

Hence, if $\phi = 0$, then in equation (2), $\alpha = 1$

The test consists of testing the negativity of ϕ in the OLS regression in equation (3). If $\alpha<1$, this implies that X_t is integrated of order zero or a stationary process. Based on this, it can be said that Dickey-Fuller tests are testing the negativity of ϕ for stationarity to be obtained. At this point knowing the distribution of the statistic used for the test and their associated critical regions for its evaluation is important.

4.3.2 The Augmented Dickey - Fuller (ADF) Test

Augmented Dickey- Fuller test (ADF) as specified by Granger and Engle (1987) follows the same procedure as the DF; when (ϕ=1), the series are differenced to make it stationary. Augment Dickey-Fuller tests were performed by introducing the lags of the dependent variables. To avoid spurious results the non-stationary variables are differenced to remove any stochastic trends in the series.

Unit root tests were conducted using the Dickey- Fuller test (DF) and the Augmented Dickey- Fuller test (ADF) the results are presented in table 4.2 below.

Table 4.2: The results of unit root tests on the variables in levels (DF and ADF)

Variable	DF	ADF	Order of integration
LLE	-4.8762	-3.11	I(k), k>0
LIM	-1.6162	-1.221	I(k); k>0
LU5M	-1.483	-1.406	I(k); k>0
LASWt	-1.4080	-0.6533	I(k); k>0
LEER	-0.97383	-0.3023	I(k); k>0
LEED	-1.7313	-2.229	I(k); k>0
LHED	-0.51295	0.2925	I(k); k>0
LHER	-1.7843	-1.005	I(k), k>0
LY/N	-2.2255	-2.624	I(k); k>0
LHE/n	-1.41	-0.558	I(k); k>0
LEE/n	-0.6444	-0.2189	I(k), k>0

The results shows that the variables are non-stationary. We therefore accept the null hypothesis that the variables are integrated of order higher than zero. The variables are differenced and subjected to the same tests. The results of the differences are presented in table 4.3 below.

Table 4.3: The results of unit root tests on the variables in after differencing (DF and ADF)

Variable	DF	ADF	Order of integration
DLLE	3.665	-1.327	I(0)
DLIM	-5.01	-2.706	I(0)
DLU5M	-4.165	-1.695	I(0)
DDLASWt	-7.56	3.008	I(0)
DLEER	-5.064	-3.391	I(0)
DLEED	-4.465	-0.892	I(0)
DLHED	-5.511	-2.488	I(0)
DDLHER	-3.677	-3.603	I(0)
DDLY/N	-6.975	-2.729	I(0)
DLHE/n	-6.612	-2.347	I(0)
DLEE/n	-7.151	-2.897	I(0)

The first differences of all the variables except income per capita, access to safe water and recurrent health expenditure are stationary. This implies that these variables are integrated of order one. Income, access to safe water and recurrent health expenditure are integrated of order two as their second differences are stationary.

4.4 COINTEGRATION ANALYSIS

This analysis combines both short-run and the long run properties and the same time maintain stationarity in all the variables. Such an analysis tests the existence of long-run relationship between an independent variable and its explanatory variables. If two or more variables are integrated of the same order and their differences have no clear

tendency to increase or decrease then this will suggest that their differences are stationary. Thus if non-stationary series have a long-run relationship any deviation from this long run path will be stationary. Put differently, if the linear combination or the residual from the variables is integrated of order zero I(0), then this will be a case of cointegration (Adam, 1992). The existence of cointegration is important because failure to find cointegration between variables will be a manifestation of the existence of spurious correlation in which case valid influence will not be realized (Ibid).

We conduct cointegration test to test whether the variables have long-run relationship. The tests normally fall into two categories, the residual based tests and the Johansen approach. This study uses the Granger and Engle-two step procedure (Residual-Based test). This step is taken under this procedure is as follows.

$$E_t = b_0 + b_1 F_t + e_t \quad \ldots\ldots(5)$$

In this case we first get the static equation of the variables in levels then we generate the residuals. Test of stationarity is done on the residuals. If the residuals are stationary then the two series are cointegrated. The Engle-Granger co-integration test results on residuals of models presented the appendix (3) at the back

Based on the Engle-Granger cointegration test results reported in appendix (3), we accept that there is cointegration between variables as we reject the null hypothesis of no-cointegration at the five per cent significance level. These results suggest that an error

correction specification will provide a better fit than one without the error correction variable.

The regression results provide some important statistic upon which interpretation is done and decision made as to whether the estimated model can be expected to be relayed on. However, these statistics alone are not sufficient to base decision on. It was therefore necessary to perform other diagnostic tests.

4.5 DIAGNOSTIC TESTS

We now perform the following diagonistic tests. The tests are necessary since they will indicate whether the models are consistent or not.

4.5.1 Jarque-Bera (JB) test

The first test done was to determine the distribution of the error term. This has to be normally distributed if the OLS is to efficient and consistent method of estimation (Adam, 1992). The Jarque-Bera test is utilized for this purpose and focusese on the first four moments of distribution (i.e. the mean, standard deviation, skewness and excess kurtosis in addition to the minimum and maximum values), of the series to construct a distribution. The difference is distributed as a chi square statistic. This is compared to the standard normal distribution obtained. If the calculated chi square statistic for the error distribution fall below the critical chi square value at some confidence level, then normal distribution of the errors is not rejected.

Table 4.4: Jarque-Bera normality test for Residuals.

Statistic	DLLE-aggr.	DLLE-disaggr	DLIM-aggr.	DLIM-disaggr	DU5M-aggr.	DU5M-disaggr.
Mean	0.0000	0.00000	0.00000	0.0000	0.00000	0.00000
Std. Dev.	0.00292	0.00312	0.05651	0.06378	0.05493	0.03952
Skewness	-0.19381	-1.2062	0.02857	-0.03423	0.37142	0.00474
Excess kurtosis	-0.10581	1.9543	-0.62325	0.06089	-0.53460	-1.4723
Minimum	-0.00688	-0.0099	-0.11559	-0.13819	-0.10467	-0.0611
Maximum	0.00579	0.0049	0.10296	0.15071	0.10066	0.05843
Normality chi sq.	0.8244	6.8995	0.00749	1.2649	0.63084	3.5628
Normality prob.	0.6622	0.0318	0.9963	0.5313	0.7295	0.1684

The results tabulated in table 4.4 indicate that the calculated chi square fall below the tabular chi square of 5.99 at 5% significance level. We conclude that the the error term is normally distibuted and hence the OLS etsimation method will be consistent and efficient.

4.5.2 The Autocorrelation test (AR)

This is a test for autocorrelation and is used because the DW statistic is not effcient when higher lagged order of the depent variable are included as explanatory variables. In this paper, AR test show that there is no serial correlation. Its only efficient as an indicator of autocorrelation but when its of the first order. To obtain better result the AR(m) test is done. The test takes a chi square distribution. For small samples of less than 50 obversations use of a F- form statistic is preferred.

Table 4.5: The AR test results

Statistic	Model					
	DLLE-aggr.	DLLE-disaggr	DLIM-aggr.	DLIM-disaggr	DU5M-aggr.	DU5M-disaggr.
F-computed	F(2, 15) = 1.264	F(2, 16) = 3.956	F(2, 16) = 1.8019	F(2, 15) = 0.415	F(2, 8)= 4.4867	F(2, 4) = 0.1529
F-critical	3.68	3.63	3.63	3.68	4.46	6.94

The values of F-statistics calculated are less than the critical values, thus we reject any serious error autocorrelation.

4.5.3 The Autoregressive Conditional Heteroscedasticity test (ARCH)

The ARCH test was used to test for the existence of heterosedasticity.The test statistics obtained from the test indicate absence of heterosedasticity. Normality test shows that the residuals are normally distributed.

Table 4.6: The ARCH test results.

Statistic	Model					
	DLLE-aggr	DLLE-disaggr	DLIM-aggr.	DLIM-disaggr	DU5M-aggr	DU5M-disaggr.
ARCH	F(1, 15)= 0.37247	F(1,16)= 0.51156	F(1, 16)= 0.2100	F(1, 15)= 2.3924	F(1, 8)= 0.7821	F(1, 4)= 0.31433
F-critical	4.54	4.49	4.49	4.54	5.32	7.71

From the table 4.6 above, the computed F values fall below the critical F-values. This implies that we reject the presence of ARCH for all the equations.

4.5.4 The regression specification test (RESET).

This test is used to investigate whether there is any non-linearities in the equations. This test also makes use of F statistics. If the calculated values are higher than the critical F-values, non-linearity is accepted.

Table 4.7: the results of RESET test.

Statistic	Equation					
	DLLE-aggr.	DLLE-disaggr	DLIM-aggr.	DLIM-disaggr	DU5M-aggr.	DU5M-disaggr.
RESET	F(1, 16)= 9.575	F(1, 17)= 7.363	F(1, 17)= 0.915	F(1, 16)= 0.0378	F(1, 9)= 0.173	F(1, 5)= 0.157
F-critical	4.49	4.45	4.45	4.49	5.12	6.61

Results tabulated in table 4.7 indicate that we accept the null hypothesis and conclude that the models are properly specified as linear.

4.6 REGRESSION RESULTS

Table 4.8: Modelling DLIM by OLS: Dependent variable is IMR

Variable	Coefficient	t-value	t-probability
Constant	-0.0204	-0.876	0.3928
DLHE/n	-0.2699	-2.808	0.0116
DLEE/n_1	0.3057	2.441	0.0252
DDLASWt	-0.3118	-3.818	0.0013
DDLASWt_1	-0.2298	-2.881	0.0099
DDLY/N	-0.1279	-1.366	0.1889
RE-IM2_1	-0.0462	-0.282	0.7812

$R^2 = 0.619$ F(6, 18) = 4.8766 [0.0040] DW = 2.09

Tables 4.8 presents' results of infant mortality rate on aggregated data. Most of the coefficients have the expected signs and are consistent with the aproiri expectations. The health expenditure, access to safe water and its lag significantly reduce the infant mortality rate. The a coefficients for health expenditure, access to safe water and lag of safe water –0.2699, –0.3118 and –0.2298 respectively. However, lagged variable of education expenditure (DLEE/N) does not have a negative sign as expected. This implies that increase in previous period's education expenditure (DLEE/n_1) leads to reduction in infant mortality rate. Income (DDLY/N) had a coefficient of –0.1279 but insignificant. The R^2 is 0.619 implying that 62 percent of variations of infant mortality rate (IMR) are explained in the model. The DW = 2.09 indicate that there is no existence of serial autocorrelation in the error term.

Table 4.9 Modelling DLIM by OLS: Dependent variable: IMR

Variable	Coefficient	t-value	t-prob
Constant	-0.0805	-1.759	0.1539
DDLY/N	-0.0485	-0.411	0.0099
DDLASWt	-0.2338	-2.216	0.2242
DLHER	0.2164	0.962	0.0516
DLHED	-0.0007	-0.015	0.0000
DLHED_1	-0.0543	-1.138	0.0708
DLEED	-0.1291	-2.189	0.2200
DLEER_1	0.3973	1.736	0.1507
Re-im1_1	-0.8178	-2.663	0.2943

R^2 = 0.496 F(8, 17) = 2.0898 [0.0959] DW = 1.82

Table 4.9 presents results of infant mortality rate on disaggregated data. From the results the model captures about 50% of the variation of infant mortality rate. The DW = 1.82 this is close to two (2) implies minimal serial autocorrelation in the error term. The t-values of variables such as access to safe water and development education expenditure suggest that the coefficients are significant. While the remaining t-values in the equation suggest insignificance of the coefficients in the equation. Most of the coefficients have the expected signs except recurrent expenditure on health and education, which have positive signs, but they do not seems to be statistically significance. The results suggest that the lagged variable of recurrent education expenditure have a large positive effect on infant mortality. However it is not significant meaning that it has no effects in the short/ run.

In both the infant mortality models, access to safe water and education's effects are statistically significant. The results indicates that 1% increase in recurrent expenditure per

capita on health would lead to a 0.2164% decline in infant mortality rate respectively. The elasticities –0.129 and –0.2338 of development expenditure on education and access to safe water to IMR are stated above.

Table 4.10: Modelling DLLE by OLS :

Variable	Coefficient	t-value	t-prob
Constant	0.0033	2.238	0.0389
DLLE_1	0.4636	2.425	0.0267
DDLY_N	0.0011	0.206	0.8393
DDLASWt_1	-0.0026	-0.602	0.5552
DDLASWt_2	-0.0139	-3.060	0.0071
DLHE_n_1	0.0084	1.320	0.2043
DLEE_n_1	-0.0119	-1.473	0.1590
Re-le2_1	-0.0532	-0.808	0.4300

$R^2 = 0.464$ F (7, 17) = 2.1058 [0.0994] DW = 2.39

The results of life expectancy on aggregated data are presented in table 4.10. The DW = 2.39 implies minimal serial autocorrelation in the error term. The t-values of the constant, the lagged exogenous variable and the second lag of access to safe water show that they are significant. Some of the coefficients such as the previous expenditure on education and access to safe water do not match with the expected sign. From the results the lag of life expectancy most significantly explains life expectancy with a coefficient of 0.4636. The lagged variable of access to safe water also significantly explains variations in life expectancy. The second lag of access to safe water has a coefficient of –0.0139. The education and health expenditure were marginally significant with respective coefficients of –0.0119 and 0.0084 respectively. The results can be interpreted to mean that the level of life expectancy depends on the magnitude of government expenditure.

Table 4.11: Modelling DLLE by OLS: Dependent variable: DLLE

Variable	Coefficient	t-value	t-probability
Constant	0.0056	3.107	0.0061
DDLASWt	0.0015	0.327	0.7472
DDLY/N	0.0060	1.122	0.2765
DDLHER	-0.0034	-0.419	0.6801
DDLHED	-0.0036	-1.624	0.1217
DDLEED	0.0064	2.275	0.0353
DDLEER	0.0022	0.204	0.8410
Re-le_1	-0.2194	-1.803	0.0881

$R^2 = 0.363$ F(7, 18) = 1.4654 [0.2413] DW = 1.35

Life expectancy was modeled on disagregated data and the results are presented on table 4.11 above. The model explains 36% of the variation of life expectancy. The DW is 1.35 indicating the presence of some positive serial autocorrelation in the error term. The result shows that the health expenditure both recurrent and development fail to capture the expected sign. From the results, development expenditure on education significantly explains life expectancy but the coefficient is insignificant (0.0064). This implies that 1% increase in development education expenditure will lead to 0.0064% increase in life expectancy. Income is marginally significant with 0.006 as the coefficient. All the variables have small elasticities. Most of the t-values are low suggesting that the co-efficient are not statistically significant. The estimated negative effect of recurrent and development health expenditure per capita on life expectancy is clearly unexpected. However, the elasticities of both recurrent and development expenditure per capita on health are -0.0034 and -0.0036 respectively and not statistically significant. In the case of population with access to safe water, the coefficient is 0.0015. This input generally improves life expectancy, in the sense that access to safe water is important in maintaining better health. Population with access to safe water showed the expected

effect with an elasticity of 0.0015 indicating that if expenditure are increased by 1% life expectancy would improved by 0.0015%. Based on the estimation, development expenditure on education was a major concern in influencing life expectancy unlike recurrent expenditure. The elasticity of development expenditure on education in life expectancy is 0.0064 and is statistically significant at 5% level.

Taking into consideration the relationship between life expectancy and income form both models, the per capita income elasticity is quite small and is statistically insignificant. The result implies that a 1% change in per capita income leads to an increase of life expectancy of 0.0011% and 0.006% for aggregated and disaggregated data respectively.

Table 4.12: Modelling DLU5M by OLS: Dependent variable: DLU5M

Variable	Coefficient	t-value	t-probability
Constant	0.0064	0.219	0.8311
DLHE_n	-0.3284	-2.606	0.0262
DHE_n_1	-0.4935	-2.449	0.0343
DLEE_n_1	0.5644	2.509	0.0310
DDLY_N	-0.1346	-1.17	0.2691
DDLASWt	-0.663	-5.059	0.0005
DDLASWt_1	-5.034	-4.168	0.0019
Ecm_1	-0.1748	-0.765	0.4622

$R^2 = 0.798$ $(7, 10) = 5.6547\ [0.0074]$ DW = 1.83

Under-5 mortality rate (aggregated data) results are reported in table 4.12. The R^2 is 0.798 and shows that the explanatory power is approximately 80%. The DW is 1.83 and shows the presence of minimal serial autocorrelation in the error term but is still acceptable as its close to two. Most of the coefficients in the equation have taken their

expected signs showing that they negatively affected under-5 mortality rate except the lagged education expenditure. The health expenditure and its lag, access to safe water and its second lag are significant. Their respective coefficients are –0.3284, -0.4935, -0.663 and –5.034. The second lag of access to safe water has a large elasticity of -5.034 implying that 1% increase in the second lag of access to safe water leads to 5.034% decline in under-5 mortality rate. However, the other variables are inelastic. The education expenditure, which do not have the expected sign, affected under-five mortality rate positively.

Table 4.13: Modelling DLU5M by OLS

Variable	Coefficient	t-value	t-prob.
Constant	0.0857	1.143	0.2965
DDLY/N	0.0258	0.230	0.8260
DDLASWt	-0.7751	-4.844	0.0029
DDLASWt_1	-0.6196	-4.460	0.0043
DLHER	-0.5923	-1.439	0.2003
DLHED	-0.0667	-1.156	0.2916
DLHED_1	-0.0835	-1.541	0.1743
DLEED	-0.1400	-2.045	0.0868
DLEER	-0.3638	-0.996	0.3578
DLEER_1	0.5009	1.344	0.2276
Res-u5_1	-0.2952	-0.724	0.4961

$R^2 = 0.901$ F (10, 6) = 5.4767 [0.0248] DW = 2.06

Table 4.13 reports the results of under-five mortality rate on disaggregated data. The R^2 shows that 90% of the effects of the variables in the equation are captured. The DW is 2.06 indicate that there does not exists serial autocorrelation in the error term as the statistic is very close to two. Most of the coefficients have the expected sign. However the results shows that income is positively related to under-five mortality rate. This is against the theoretical expectations and the study hypothesis. Access to safe water, its

first lag and development education expenditure are statistically significant. All the other variables apart from income and recurrent expenditure on education are marginally significant. The coefficient of recurrent health expenditure is -0.59. This indicates that a 1% increase in the expenditure would lead to 0.59% fall in under-five mortality rate. The elasticity of recurrent and development expenditure per capita on education on under-five mortality is-0.363 and -0.140 respectively. It is evident that a 1% increase in per capita recurrent and development expenditure on education will leads to 0.363 % and 0.14 % reduction in mortality respectively.

Access to safe water has the expected effect on under-five mortality. Population with access to safe water has the elasticity of -0.775 and its lag has -0.620 in the model that used disagregate data. They are statistically significant at both 1% and 5% levels. This indicates that an increase of 1% in the population with access to safe water leads to a 0.775% and 0.62% decline in under-five mortality rate respectively.

4.7 DISCUSSION OF THE RESULTS

Six equations were estimated which are infant mortality rate, life expectancy and under-five mortality rate on aggregated and disaggregated data. The focus of the econometric analysis was on the importance of income and expenditure on health and education in improving health. We used a log-log specification to estimate the various health effects of these two sets of variables. The coefficients of the double-log model specification are elasticities.

The result indicate that education decreases infant mortality and under-five mortality improves with education. Perhaps, the reasons for this finding could be explain that if more Kenya women are educated, infant mortality and under-five mortality will reduce. "An educated girl is likely to marry later, have few children and provide better care to herself and her children than a girl without education. As more women become educated, there is a cumulative effect on more households. As more household become smaller the provision of care improves children. Taken together, education among women adds up to a virtuous circle of social development" (Mehrotra, 2000).

Based on the estimation results, income elasticities were found not to be statistically significant, income has the expected effect on life expectancy and infant mortality. The expected negative effect is evident in the three out of the four mortality models. Life expectancy is positively related with income. This clearly indicates that individuals are able to use their income in accessing care for themselves and their families, such as seeking medical intervention and maintaining better standards of hygiene. The results so far show that the social welfare and well being is a major significant determinant of health status.

Based on under-five and infant mortality rates both aggregate and disaggregate regressions, the per capita income was not significant in explaining the levels of mortality. However, the per capita income shows that it has elasticity of -0.048 for disaggregated data and -0.128 for aggregated data of the infant mortality. This shows that an increase in 1% per capita income will lead to a decline in 0.048 % and 0.128% of

infant mortality rate. In the case of under-five mortality, per capita income has the elasticity of -0.135 for aggregated data and 0.023 for disaggregated data. This indicate that a 1% increase in per capita income will lead to a decline of 0.135% and 0.023% in under-five mortality rate. The income elasticity of under-five mortality on disaggregated data does not correspond to the hypothesized expectation but it is not statistically significant. So far, from the result we obtained, it is true that Kenya registered reasonable improvement in the health status over the period analyzed. With all the economic disadvantages in the past decades.

We included other variables as explanatory variables in the regression model including total government expenditure on health, dis-aggregated into recurrent and development expenditure in terms of life expectancy, infant mortality and under-five mortality. In the case of life expectancy, it is clear that the estimation of both recurrent and development expenditure on education improve life expectancy.

Finally, it is clear from the result discussed above that expenditures on education and health care improve health status.

CHAPTER FIVE

5.0 CONCLUSION AND POLICY IMPLICATION

The main focus of this study was to empirically estimate the impact of public expenditure and health status in Kenya, over the period 1972-2000. The results presented in this paper show a remarkable amount of variation in health status, as measured by life expectancy, infant mortality rate and under-five mortality rate. The variation in health status is explained by income, education, health and access to safe water. Moreover, the results show that, although income is an important determinant, other factor are significant determinants of health status.

In addition, higher public expenditure on health as a share of GDP is shown to be very tenuously related to improved health status. The conclusion was precisely based on the health production function model that per capita income, it plays an influential role in enhancing health status indicators. The study further reveals that the per capita recurrent and development expenditure on health care and per capita recurrent expenditure on education are important in explaining changes in life expectancy, changes in infant mortality rate and under-five mortality.

5.1 POLICY IMPLICATION

The study has established the significance of public expenditure on health and education in influencing the health status in Kenya. This has policy implications, which should be addressed with a view to improving the health care system in Kenya. In real sense some of the negative trend in health status could be basically associated with insufficient social

spending on health. With regards to the policy variables in this paper which include per capita income and public expenditure on health and education. In this regards therefore, the variables need a profound attention in other to form the public policy to improve health status.

In order to improve health and education, the Government of Kenya in her macro-economic policies needs to think about the health sector critically, since some of the policy impact negatively on health care.

In terms of expenditure allocations by the Ministry of health, the health budget should be increased in real terms and the bulk of the expenditure must be channeled towards primary and preventive health care. Greater finances and health care resources (including drugs and staff) should be directed to primary care clinics and district hospitals where the majority of the people seek health care. Maternal health care services deserve more attention to enhance access to majority. More resources should be channeled towards HIV/AIDS campaign.

In the case of education, it is true that quality education is necessary in order to achieve desired behaviors. More resources should be allocated to primary education to ensure equity and the reduction of poverty. Boys and girls should be given equal access to education. This would enhance female literacy levels and lead to better health outcomes. The government should encourage the private sector to provide education and health care. Transparency and accountability should be a constitutional requirement with

regards to the national budgetary process. The government should stop directing more resources to defense because it has no direct effect on social welfare. Introduction of a maximally publicized national audit of public finances at specified intervals. The role of local authorities in education, health and education sector should be clearly articulated.

5.2 LIMITATION OF THE STUDY AND AREAS OF FURTHER RESEARCH

Inspite of the efforts expended on ensuring that the study is complete, it must be conceded that our study has some inherent limitations. Since data collection and measurement in Kenya does not correct, it is likely that measurement errors are obtained in the national account data used in this study. The more reliable situation as a major limitation is availability of data in the year 1972 of the study on under-five mortality rate. With this abnormality the data was only obtained from 1980-2000 not from 1972-1979.It is difficult for the study to make recommendation on this issue because central Bureau of statistic renew the data entry systems but they never incorporated the earlier period.

BIBLIOGRAPHY

Abel-Smith B., (1963), "Paying for Health Services", ***Public Health Paper***, No.2, World Health Organization, Geneva.

Abel-Smith B., (1967), "An International Study of Health Expenditure." ***Public Health Paper***, No.2, World Health Organization, Geneva.

Adam C. S, (1992), "Recent Development in Econometric Methods: An application to the demand for money in Kenya" ***AERC Special Paper***, No.15, Nairobi, Kenya.

Alesina.A, R. Baqir, W. Easterly, (1997), Public Goods and Ethnic Divisions. ***NBER Working Paper*** No.6009. Cambridge.MA., London.

Anand. S. and S. Ravallion, (1993), "Human development in poor countries: on the role of private Income and public services," ***Journal of Economic Perspectives***, Vol. 7, No1.

Bidani B. and M. Ravallion, (1997), "Decomposing social indicators using distributional data" ***Journal of Econometrics***, Vol. 77.

Boo Sjoo (1996), ***Lecture in Economic Time series Modelling*** School of Economics and commercial Law, Department of Economics, University of Gothenburg, Sweden.

Caldwell C. J., (1990), "Cultural and Social Factors Influencing Mortality Levels in Developing countries," ***The Annals of the America Academy***, Vol. 510.

Caldwell, C. J., (1986), "Routes to low mortality in poor countries," ***Population and Development Review***, Vol.12, No2.

Carn G. (1988) "Community Financing of Health care," World Health Forum, Vol. 9.

Cuyler, A. J., (1989), "Health, Health Expenditures and Equity" ***Discussion Paper*** No.83, University of York Centre For Health Economics.

Dickey, D.A., and W.A.Fuller 1970,"Distribution of the Estimators for Autoregressive Time series with a unit root". ***Journal Of The American Statistical Association***, Vol. 75.

Dickey, D.A and W.A.Fuller 1981 "Likelihood Ratio Statistics for Autoregressive Time series with a Unit root", ***Econometrica,*** Vol. 49.

Engle R. F. and Granger C. I., (1987), "Cointegration and error correction, representation, estimation and testing" ***Econometrica***, Vol. 55, No. 2.

Filmer D., J. Hammer, and L. Pritchett, (1998), "Health Policy: Weak Links In the Chain" ***World Bank PR Working Paper***, No. 1867, The World Bank, Washington, DC.

Geoff H. and A. Mills, (1986), "Paying for the health sector review and annotated bibliography of the literature on developing countries" ***EPC Publication***, No.12, London School of Hygiene and Tropical Medicine, London.

Gertler P. and V. Gaag, (1990), ***The Willingness to Pay for Medical Care: Evidence from two Developing Countries***, Baltimore: The John Hopkins University Press, Baltimore.

Granger, C. W. J. and Newbold P 1974, "Spurious Regression in Econometrics," ***Journal Of Econometrics*** Vol. 14.

Government of Kenya, (1989), Demographic and Health Survey, Kenya Population Council, Nairobi,

Government of Kenya, (1996), "Estimates of Recurrent Expenditure," Government Printer, Nairobi.

Government of Kenya, (1997), Public Expenditure Review, Ministry of Finance/OVP and MNPD.

Government of Kenya, (2001), National Development Plan (1997-2001), Government Printers, Nairobi.

Government of Kenya, (2001); Ministry of Finance and Planning, Quarterly Budget Review, Fourth quarter 2000/2001.

Government of Kenya; Central Bureau of Statistics, "Statistical Abstracts," Various Issues

Government of Kenya; Central Bureau of Statistics, Economic Surveys, Various Issues.

Granger, C. W. J., (1986), "Development in the Study of Cointegrated Economic Variables" ***Oxford Bulletin Of Economic Statistics***, Vol. 48.

Grossman M., (1972), "On the concept of Health Capital and the Demand for Health," ***Journal Of Political Economy***, Vol. 80, No 2.

Hamilton, L.C., (1992). Regression with Graphics: A second coarse in statistics, Brook/Cole, pacific Groove, Carlifonia.

Hitiris T. and J. Posnett, (1992), "The determinants and effects of health expenditure in Developed countries," ***Journal Of Health Economic***, Vol 11.

Horae G and A. Mills, (1986), "Paying for the health sector review and annotated bibliography of the literature on developing countries," ***EPC Publication*** No 12. London School of Hygiene and Tropical Medicine, London

Jamison, D. T. Jai Wang, K. Hill and J. Londono, (1996), "Imcome, Mortality and Fertility Control in Latin America: Country-Level Performance 1960-90" ***Mimeo, LAC Technical Department***, The World Bank, Washington DC.

Kwangkee K. and P. M. Moody, (1992), "More Resources Better? Across-National perspective, Social Science and Medicine, Vol 34 no. 8.

Manyala, K., (2000), "Effects of economic growth and public expenditure on Health - The case of Kenya," Unpublished MA Thesis, Economics Department, University of Nairobi, Nairobi, Kenya.

Ministry of Health, (1993), "Strategic Action Plan for Financing Health Care in Kenya," Nairobi, MOH.

Ministry of Health, (1994), "Kenya's Health Policy Framework," Nairobi, November 1994.

Ministry of Health, (1995), "Guide to Kenya's Health Policy Framework, Implementation and action Plans," MOH, Nairobi, Kenya.

Ministry of Health, (1996), "Kenya Health Expenditure with focus on - Preventive, Primitive And Primary Health Care," MOH, Nairobi.

Murray C. J. L, R. Govindraj, and G. Chellaraj, (1993), "Global domestic expenditure on health," The World Bank, Washington DC.

Musgrove P., (1996), "Public and Private Roles in Health - Theory and Financial Pattern" ***World Bank Discussion Paper***, No.339, The World Bank, Washington, DC.
Nairobi, Feb 1986.

Newhouse, J. P., (1997), "Medical Care expenditure Cross-National Survey," ***Journal Of Human Resources***, Vol 12.

Nganda B. M. and D. O'ngolo (1999), "Public Expenditures on Basic Social Services in Kenya" Consultancy Report Prepared for Social Dimensions of Development Secretariat, Office of the President, UNDP (Kenya) and UNICEF (Kenya), Nairobi.

Nganda B. M., (1994),"Structural Reforms of the Kenya Health Care Systems", Unpublished Ph.D. Dissertation, University of York, U.K.

Owino P. S. W., (1997), "Delivery and financing of Health Services in Kenya: Critical Issues And Research Gaps," ***IPAR Discussion Paper***, Series No.002.

Owino, (2000), "Analysis of Kenya's Health Budget", IPAR, Nairobi Perspective," ***Social Science and Medicine***, Vol.34 No.8.

Phelps, (1995), Les fondements de l'economie de la santé, Nouveaux Horizons.

Rutstein, S. O. (1984), "Infant and child mortality levels and Demographic Differentials, World Fertility Survey Comparative Studies No.40," International Statistical Institute, Voorburg, Netherlands.

Schultz, T.P. (1999), "Health and Schooling Investments in Africa," ***Journal Of Economic Perspectives***; Vol.13.

Segall et. al., (1989), "Expenditure and Financing of the Health sector in Kenya," Report of a Study commissioned by the World Bank and performed in Association with the Ministry of Health.

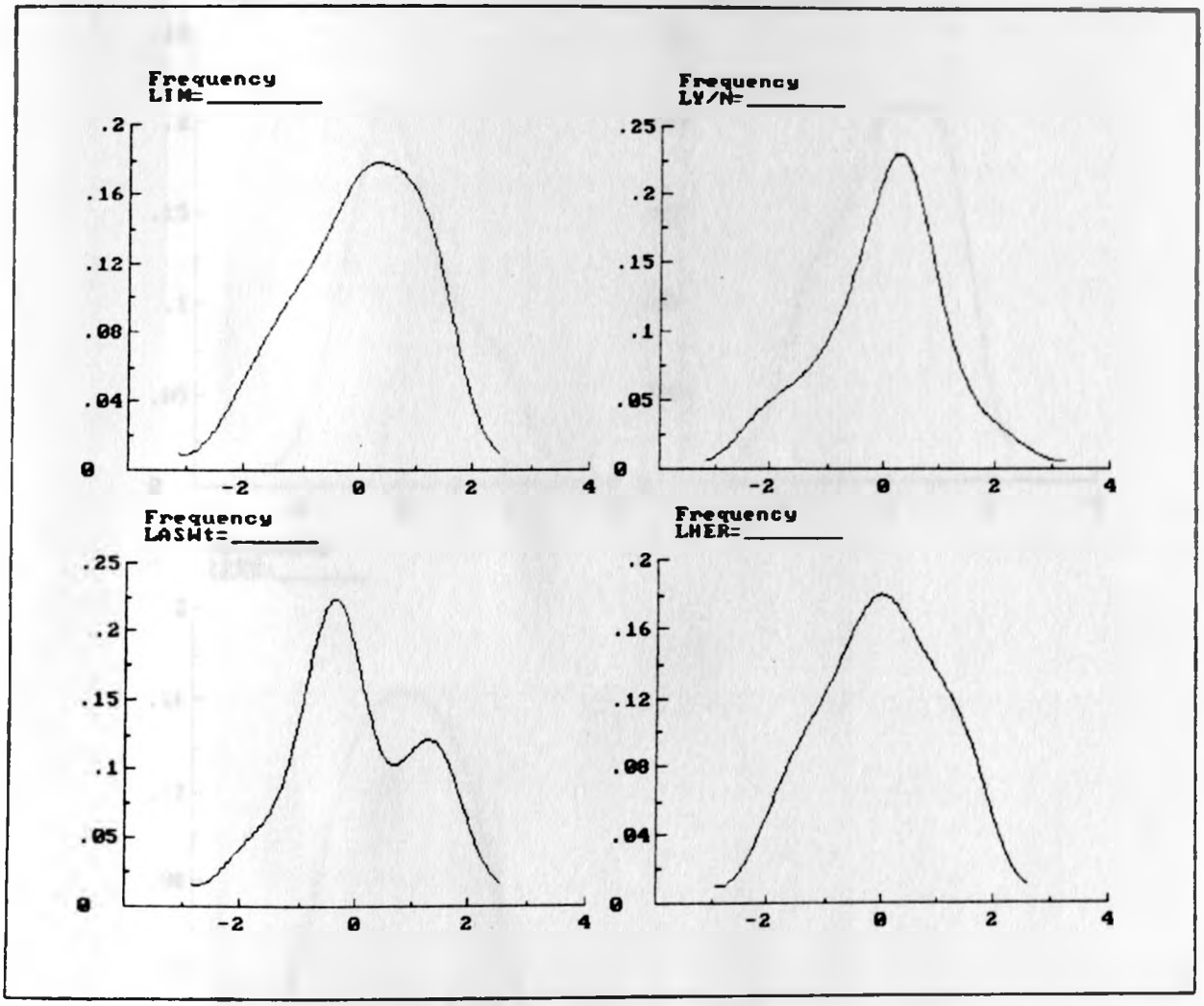
Unicef, (1992), ***The state of the world's Children***, Oxford University Press, New York

William J. (1999), ***Principles of Health Economics for Developing countries***, World Bank Institute Development Studies, The World Bank, Washington D.C.

World Bank, (1990), ***Kenya: Human Resources-Improving Quality and Access Country Operation Division, Eastern Africa Department***, The World Bank, Washington, DC.

World Health Organization, (1995), "Country Health Profile," Kenya Country Office, WHO, Nairobi.

APPENDIX 1: Frequency distribution of the data.

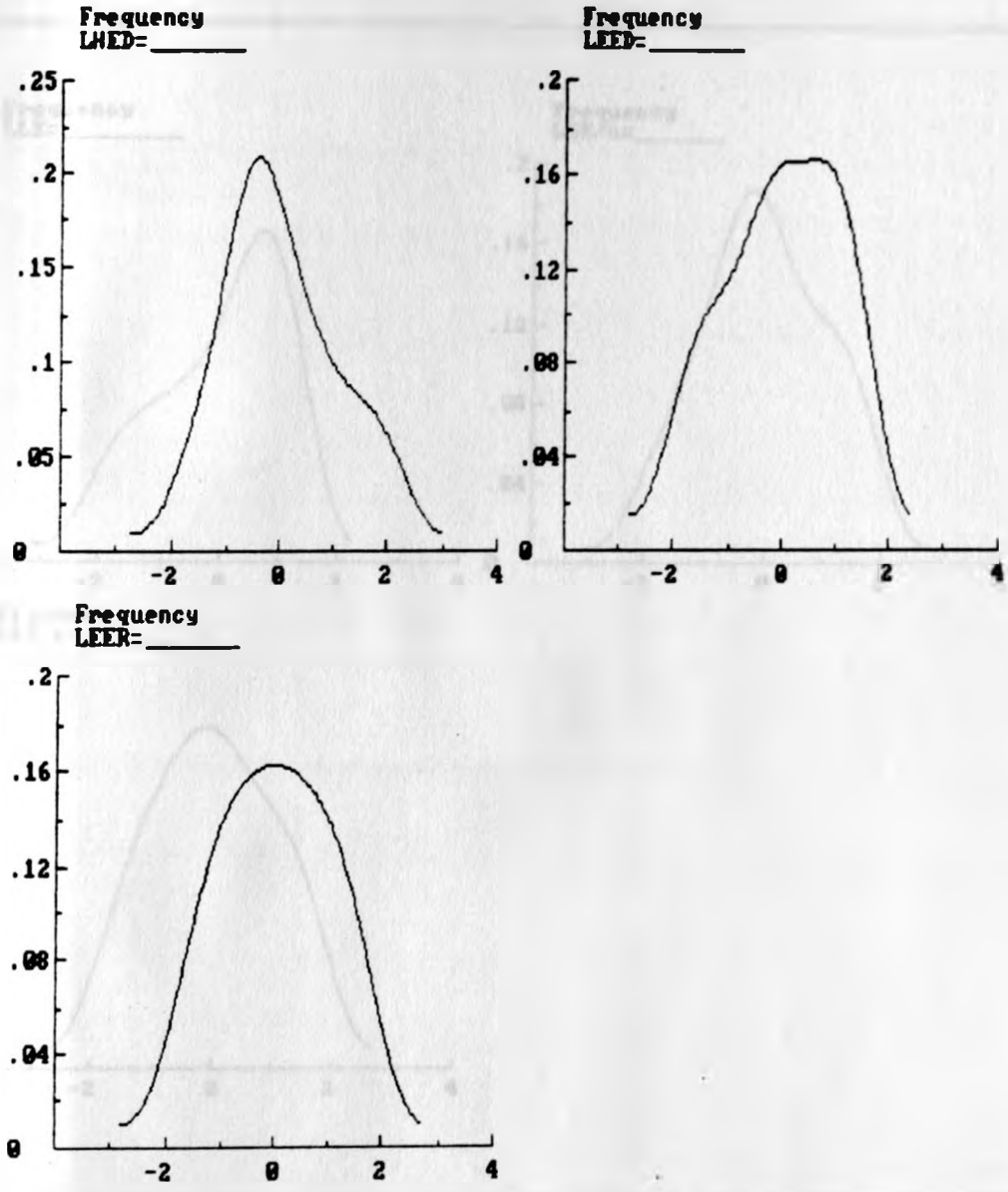


Where: LIM is the log infant mortality rate;

LY N is the log of per capita income,

LASWt is the log of the population with access to safe water;

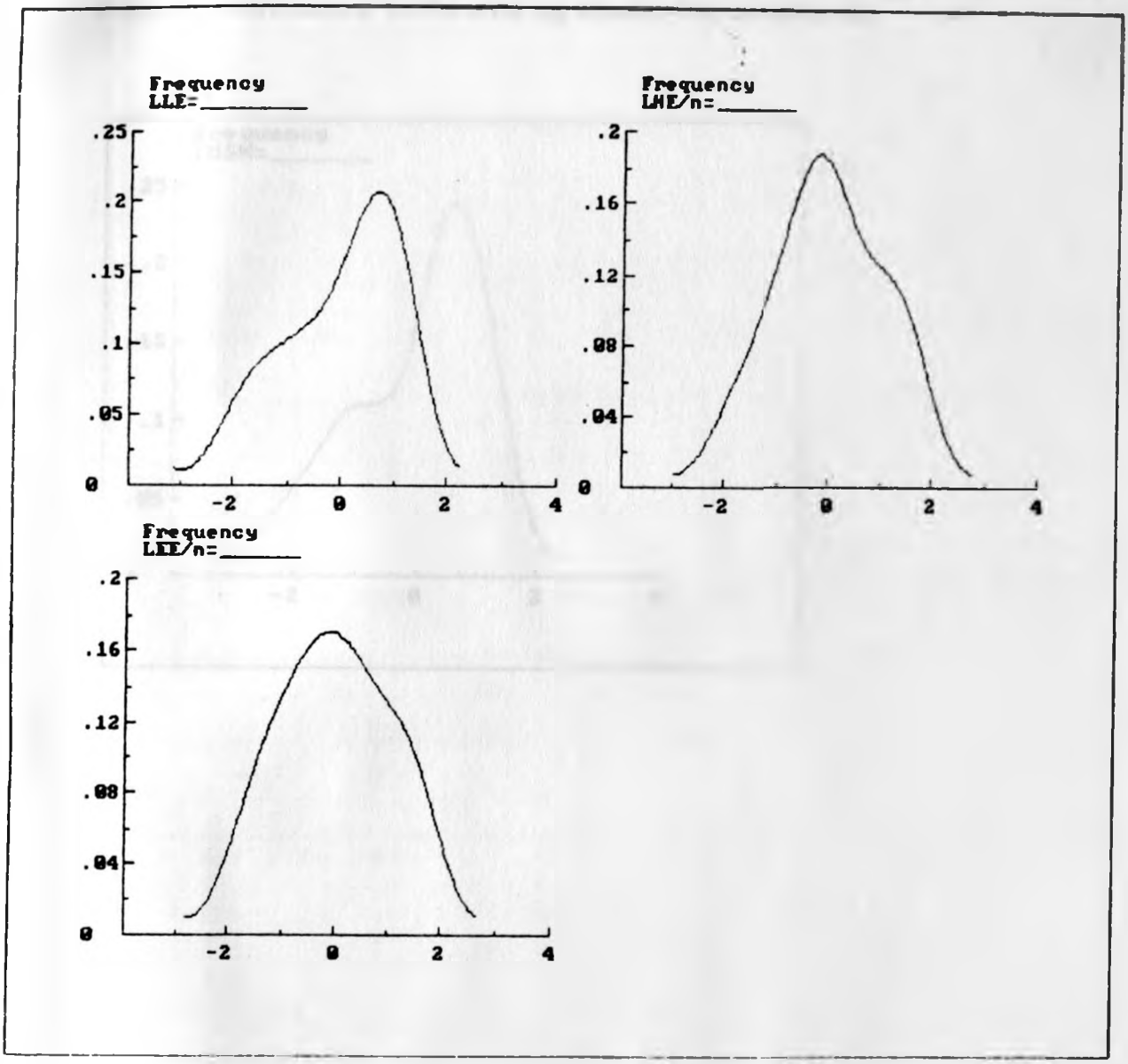
LHER is the log of recurrent expenditure on health per capita



Where; LHED is the log of development expenditure on health per capita;

LEED is the log of development expenditure on education per capita;

LEER is the log of recurrent expenditure on education per capita.

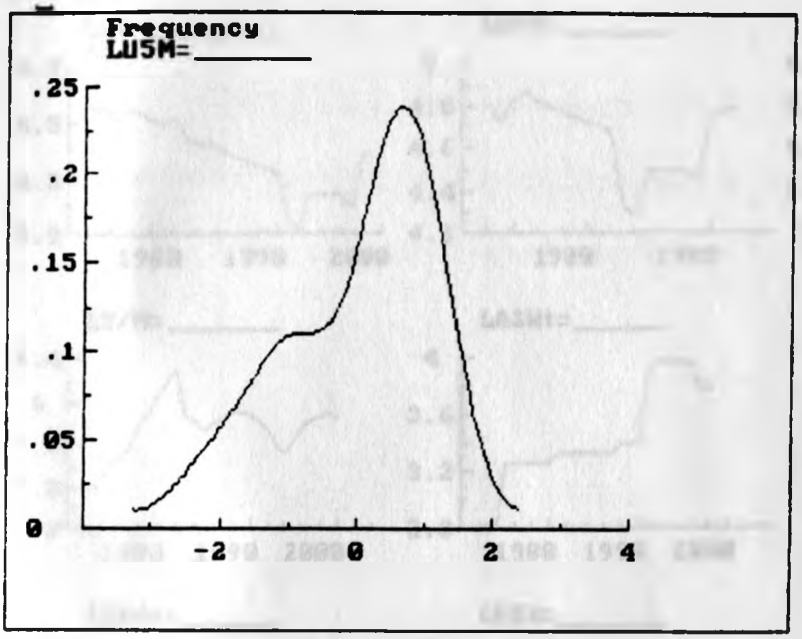


Where LLE is the log of life expectancy;

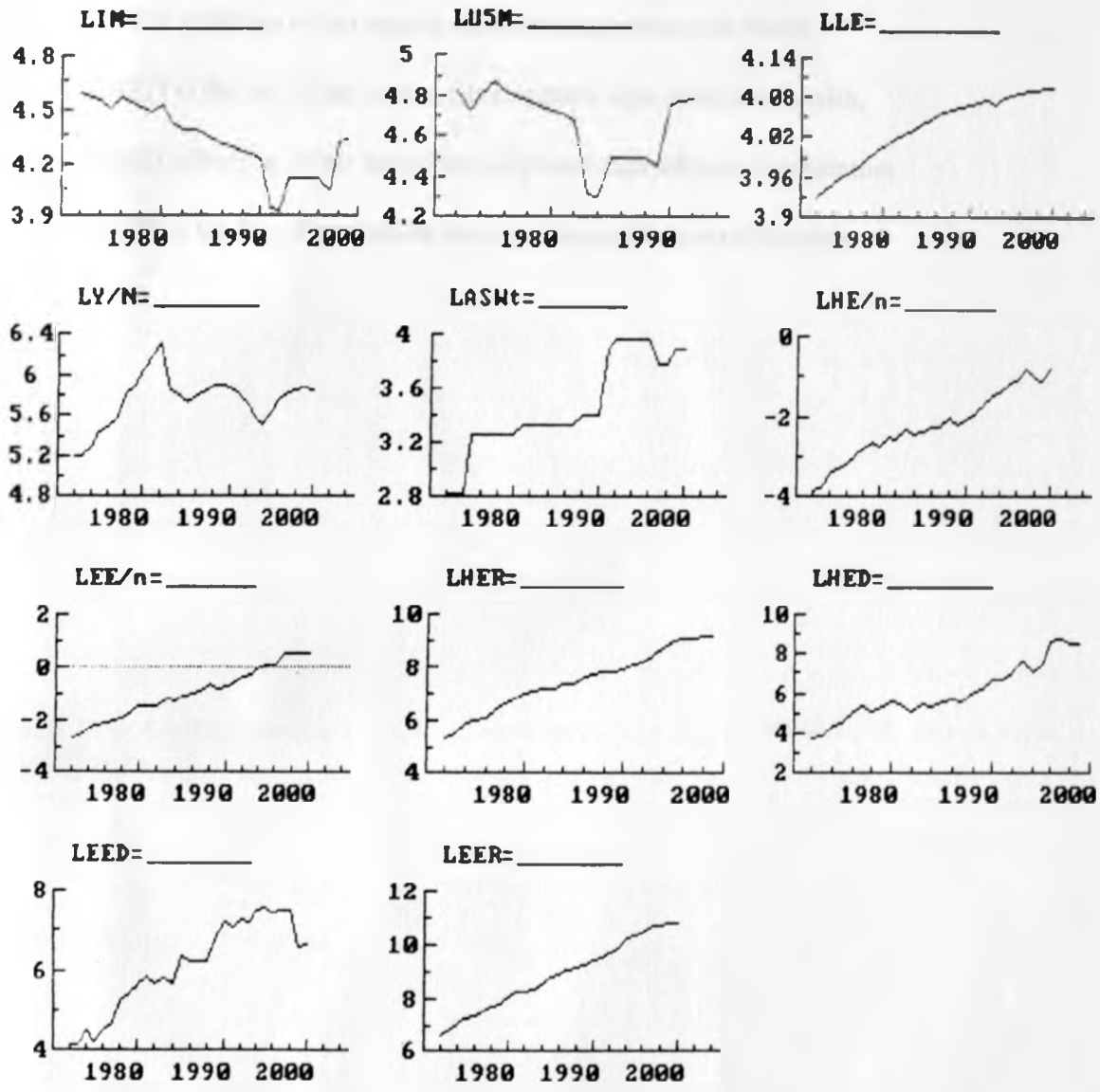
LHE/n is the log of health expenditure per capita;

LEE/n is the log of education expenditure per capita.

Frequency distribution of LU5M is the log of under-five mortality rate.



APPENDIX 2: Data stationarity



Where: LIMR is the log of infant mortality rate,

LU5MR is the log of under five-mortality rate,

LLE is the log of life expectancy,

LY/N is the log of per capita income,

LASWt is the log of the population with access to safe water,

LHE/N is the log of per capita health expenditure,

LEE/N is log of per capita education expenditure,

LHER is the log of per capita recurrent expenditure on health,

LHED is the log of per capita development expenditure on health,

LEED is the log of per capita development expenditure on education

LEER is the log of per capita recurrent expenditure on education.

APPENDIX 3: Cointegration analysis results.

Table 4.4: Co-integration results on residuals of aggregated data of infant mortality rate

Residual	t-adf	σ	Lag	t-lag	t-probability
Re-im1	-4.9272	0.056368	2	1.6737	0.1090
Re-im1	-5.3312	0.058630	1	2.3916	0.0258
Re-im1	-4.9699	0.064365	0		

Critical values: 5% = - 1.956 1% = - 2.665

Table 4.5: Co-integration results on residuals of aggregated data of life expectancy

Residual	t-adf	σ	Lag	t-lag	t-probability
Re-le1	-2.5383	0.0065	2	-0.43037	0.6711
Re-le1	-3.4275	0.0064	1	1.1429	0.2649
Re-le1	-3.3498	0.0064	0		

Critical values: 5% = -1.955 1% = -2.66

Table 4.6: Co-integration results on residuals of aggregated data of under five-mortality rate

Residual	t-adf	σ	Lag	t-lag	t-probability
Res-u5	-3.4746	0.065543	2	1.0039	0.3338
Res-u5	-3.9832	0.065561	1	1.508	0.1457
Res-u5	-4.4263	0.068498	0		

Critical values: 5% = -1.964 1% = -2.728

Table 4.7: Engle-Granger co-integration test results on residuals of infant mortality rate on aggregated data.

Residual	t-adf	σ	Lag	t-lag	t-probability
Re-im2	-1.4923	0.085286	2	-0.75955	0.4556
Re-im2	-1.9684	0.084498	1	0.84346	0.4077
Re-im2	-1.8397	0.083988	0		

Critical values: 5% -1.955 1%=-2.66

Table 4.8: Engle-Granger co-integration test results on residuals of life expectancy.

Residual	t-adf	σ	Lag	t-lag	t-probability
Re-le2	-1.8040	0.0077327	2	0.18984	0.8511
Re-le2	-1.9507	0.0075758	1	0.98582	0.3341
Re-le2	-1.6946	0.0075716	0		

Critical values: 5% = -1.955 1% = -2.656

Table 4.9: Engle-Granger co-integration test results on residuals of under-5 mortality rate on aggregated data.

Residual	t-adf	σ	Lag	t-lag	t-probability
Re-u5	-2.5124	0.097110	2	0.90956	0.3784
Re-u5	-2.5128	0.096549	1	0.89481	0.3850
Re-u5	-2.5103	0.095946	0		

Critical values: 5% = -1.964 1% = -2.728