A COMPARATIVE STUDY OF FACTORS INFLUENCING THE HEALTH STATUS OF SELECTED AFRICAN DEVELOPING COUNTRIES

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MOST NEAR, MOST DEAR, MOST LOVED AND MOST FAR

TO THE MEMORY OF MY MOTHER

TITLE OF RESEARCH: COMPARATIVE STUDY OF FACTORS INFLUENCING THE HEALTH STATUS OF SELECTED AFRICAN DEVELOPING NATIONS

SUMMARY

This study is to develop models which put into the right perspective various a-priori assumptions about factors influencing the health status of African Developing nations.

Various empirical studies have shown that the health status of nations is dependent on a variety of factors many of which define the general socio-economic conditions that are prevalent in developed economies. The a-priori assumptions elaborated in this research are based on the justification that conditions in less developed countries (LDCs) do not necessarily make the superimposition of the results of previous work on such nations realistic. Indeed, there are very few formal studies of the precise relationships which exist between health status, health services and the standard of living. Therefore a major purpose of this study is to identify and analyse a collectively exhaustive set of relevant factors and to investigate their relationships.

The theoretical model developed is based on the 'Systems Approach' and the methodology used is based on the application of certain statistical packages in social systems.

Finally, mathematical models are produced whose application would highlight certain relevant indicators such that the predicted values of these indicators would in turn help policy-makers understand the wide ramifications.

The procedures used to analyse the factors mainly involve comparative analysis, systems analysis and aggregate data analysis. The data utilised are from secondary sources, accumulated at the World Health Organisation (WHO), International Labour Office (ILO) and a few other resourceful libraries.

KEY WORDS: COMPARATIVE ANALYSIS, HEALTH STATUS, SYSTEMS APPROACH, HEALTH MODELLING

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Ph. D., 1985

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CHAPTER ONE

1.1 INTRODUCTION

Although there may be universal agreement on both the need for the possibility of improving health, there is no such widespread agreement on the best way of doing this. In fact, there are countless theories on the most effective way of raising the health of individuals and nations. These theories range from advocacy of milk pasteurisation to prohibition of cigarettes and alcohol, promotion of physical activities, etc.

There are, however, suggestions which call for an increase in the supply of health services, such as more doctors, or more hospital beds, or the ever so popular idea of economy growth. Although, according to C.E.A. Winslow that "in a given area, higher crop yields, increased power developments, or improved transportation may accomplish as much for health as more clinics and hospitals" (Winslow 1951). Perhaps the most frequently advanced proposals, however, are concerned almost exclusively with the organisation and distribution of existing health services. For example, H.E. Sigerist has said that "We have the scientific and technical means needed to overcome many diseases, but not yet the social organisation of medicine that would permit us to apply them fully" (Sigerist 1960). The sometimes fierce and bitter debate on "socialised medicine" exemplifies the concentration on organisation and distribution, or more precisely, on the reorganisation and redistribution of existing health services, as the best way to improve sub-optimal levels of health.

In all these discussions of health and ways of improving it, there is little concrete evidence on the nature of the relationships between health and the factors which may be thought to determine it. Consequently, there are not enough models to enable policy makers to predict the future level of health of a nation.

This is a study of health systems of developing countries. There are three main research issues. First, to develop a framework for studying different health systems. In this respect, the health system is looked at as an open system. The theoretical framework consists of the development of a model for the analysis of different variables affecting the health system, inside and outside this system.

The second research issue tries to establish the kind of relationships which are believed to exist between the level of health and different factors.

The third research issue develops a mathematical model to assist policy makers in the formulation of policies that enhance the future level of health of different African developing nations.

The African developing countries concerned in this study are selected from different parts of Africa in similar stages of development. The geographical situation of these countries can be seen in Appendix A-1 together with a brief note about their demographic and socio-economic situation.

1.2 METHODOLOGY

The study is composed of two parts: 1) Theoretical, 2) Analytical. In the theoretical part, we have tried to establish a theoretical framework to enable us to select different variables to be used in the second part. Thus, the theoretical framework consists of the development of a model for the analysis of different variables, which are believed to have an affect on the health status of a population.

To develop this model, we have applied systems theory; that is, we have looked at the Health System as an open system. We then, have examined the relationships of the health system with the factors inside and outside of the system. To be more clear, we have differentiated four sub-systems namely a) individual sub-system, b) institution sub-system, c) society sub-system, d) larger system.

Needless to say that each sub-system is the product of some more sub-sub-system. The sub-sub-system level was where we started to select our variables for future use.

The second part is the analytical part. In this part we have employed statistical techniques to analyse the different relationships between the variables indicating the level of health and the variables which are believed to have affect on them. The variables had previously been selected. Furthermore, by using statistical techniques we were able to introduce two mathematical models to predict the future level of health status of African nations.

The following sections state the countries and variables involved in the study.

1.2.1 Data Base

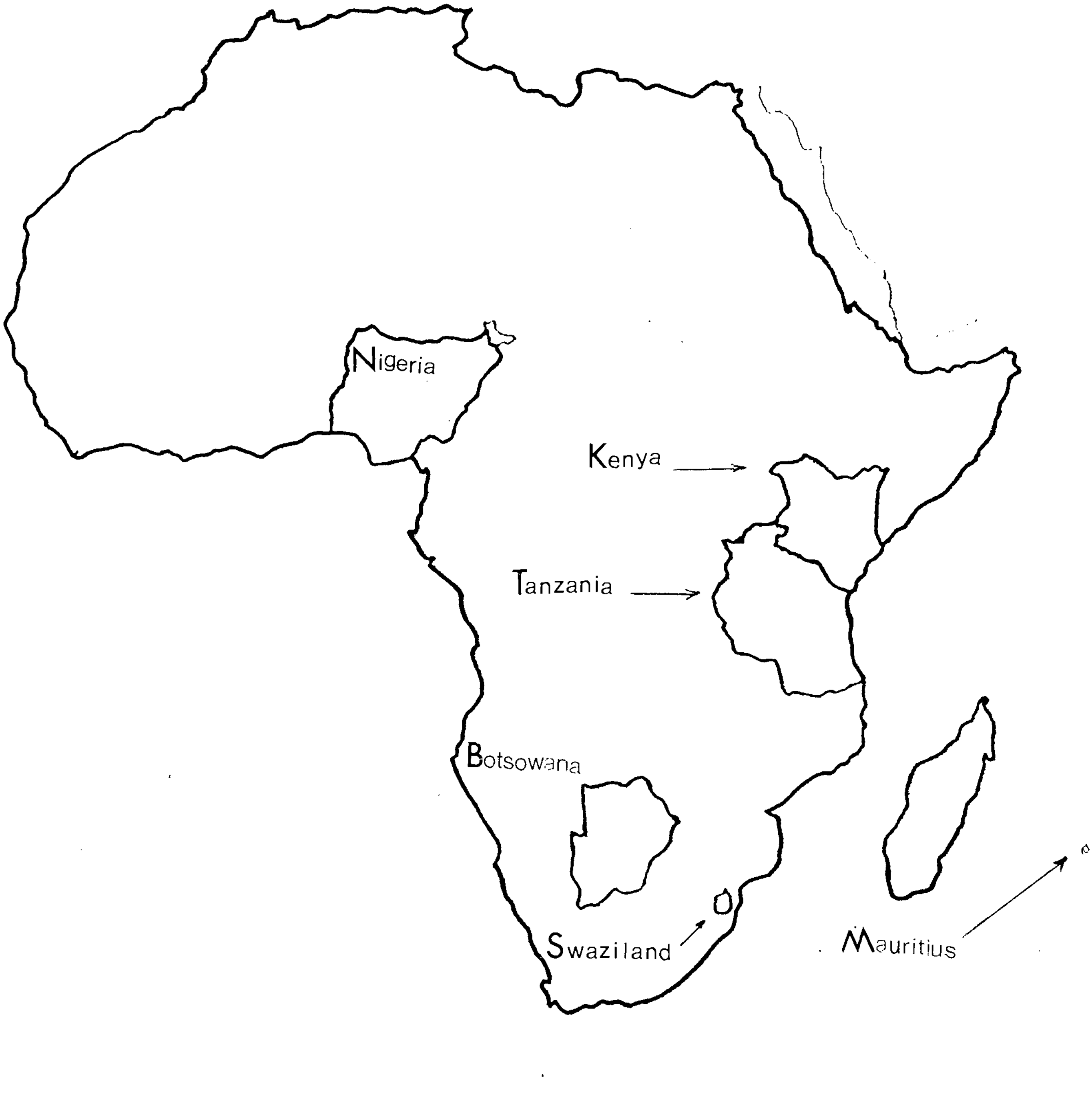
The following six countries are included in our analysis: Republic of Botswana, Republic of Kenya, Mauritius (excluding the Island of Rodrigues), Federal Republic of Nigeria, Kingdom of Swaziland, and the United Republic of Tanzania (excluding the Island of Zanzibar). These countries have been selected from different parts of Africa, figure 1.1 shows the Continent of Africa. The countries involved in the study are shown in black.

The criteria for selecting countries for the analysis are listed as follows:

1) To have governmental publications in English language;
2) The concept of different set of data (i.e., socioeconomic, demographic, and health services facilities) to be comparable;
3) To avoid the vast cultural differences.

The study covers the period from 1961 to 1980. The data is analysed in two stages, the first stage of analysis is the exploratory analysis, the data used in this section is applied in their crude form. The second stage of analysis is the explanatory stage. The data used in this stage is in aggregate form. To be clear, the data for each country was assembled in the second stage of analysis into four observation points, relating to 1965, 1970, 1975 and 1980. Each of these observation points

Figure 1.1



CONTINENT OF AFRICA

was the average of five annual observations. For example, the 1980 figures was the average of the observation of 1976, 1977, 1978, 1979 and 1980.

Assembling the data on the variables analysed has been a major task which took some two years to complete. Initially, data was taken from annual publications of individual countries, and from various international organisations such as the United Nations, World Health Organisation, International Labour Office, etc. In addition, detailed (and time consuming) correspondence with health care administrators and officials of national statistical departments was carried out in an effort to fill obvious data gaps, to revise data to fit a common definition, and in general to render the data base as comparable as possible for the countries studied. Appendix A-2 (Questionnaire) shows the questionnaire used to fulfil the above task.

A graphical representation of data can be seen in Appendix A-3 (Graphical Representation of Data) each set of data is shown against time.

1.2.2 Mortality Rate and Life Expectancy at Birth as Measure of Health Status

To measure the level of health two indicators were introduced, namely mortality rate, and life expectancy at birth. Health can be considered as a neutral state, any deviation from this state is toward ill-health. To measure the level of ill health, we had a variety of indicators to choose from. Three indicators were considered, namely, mortality rate, infant mortality rate, and morbidity rate. The data regarding mortality rate was more accessible than the other two, furthermore, a person is either dead or alive, these two states of health can be measured effectively. On the other hand, infant mortality rate was considered to refer to only a small segment of the population and therefore, could not be entirely a satisfactory measure of the level of ill health in a country as a whole. On the other hand, infant mortality is so dependent on the age structure of the population.

Any situation between the two states of being alive and being dead can be measured by the morbidity rate. In the developed countries this indicator is gaining more importance every day. Data for morbidity measures are available, diseases are classified and can be traced easily from official publications, but the pattern is not the same in the less developed countries. There are complications using the morbidity rate as a measure of the level of ill-health. Despite the greater effort of international organisations such as U.N., and W.H.O. to classify different diseases, the object is not entirely achieved in the less developed world. There are several diseases which are not even locally recognised by the community, people suffer without realising the causes of it. There are cases where people and diseases are inseperable. They are born with illness, live with illness and die with it, without noticing that they were subject to the illness. Morbidity data is very scarce, only a very few well known diseases are listed. Apart from this complication, the morbidity data can only be collected from the hospital and health centres statistics. That indicates the unreliability of morbidity data.

Life expectancy at birth was chosen as the measure of positive state of health. Since the improvement in life expectancy at birth has become slight, or even non-existant in the developed world, the importance of this indicator has become doubtful. But it still shows significant importance in the less developed world.

1.2.3 Postulated Determinants of Health Status

Four broadly defined groups of quantifiable determinants have been included in the analysis: those indicating availablility of health care resources, those indicating general socio-economic conditions, those indicating demographic conditions and finally, those indicators measuring the effect of government expenditures on health, education and agriculture.

Availability of Health Care Resources:

Three variables describing the availability of health care resources have been chosen. These variables are the number of physicians per 10,000 of population the number of nurses and paramedics per 1000 of population, and the number of hospital beds per 1000 of population.

The possibility of a close relationship between the variables indicating the availability of health resources and the two indicators of level of health are believed to be high. The close relationship is believed to be inverse in the case of mortality rate and direct in the case of life expectancy at birth.

Socio-economic factors:

The Gross Domestic Product per capita has been selected as the measure of prosperity in the less developed countries. In addition to the variable of real gross domestic product, the number of primary students as a percentage of the population has been selected to indicate the level of education in these countries.

With these two variables, the expected relation to health status as indicated by mortality rate is again thought to be inverse and direct in the case of life expectancy at birth. G.D.P. is assumed to indicate the general standard of living in a country. The higher it is, the higher the level of housing, diet, etc., and thus the lower the expected levels of mortality, and accordingly, the higher the level of life expectancy. Also, the more literate a population is, the more health education programmes can be put to them, and consequently, in the long run, the mortality rate decreases and life expectancy increases.

Demographic factors:

From the third group of variables, a percentage of the population living in cities has been chosen in an attempt to control the spatial distribution of a population. The percentage of the population living in urban areas is thought to indicate, if crudely, the potential for taking advantage of any economies of scale in the provision of health care, e.g. through higher levels of occupancy in hospitals while the quality of care provided is held constant. Thus, the greater the relative size of the urban population, the lower the level of mortality and higher the level of life expectancy expected.

Government expenditures on health, education and agriculture:

The last group of indictors to be involved in the analysis are those of government expenditures on health, education and agriculture. These indicators have been used in their crude form. Only the expenditures on health and education are broken down into two categories a) capital expenditures, and b) recurrent expenditures.

The government expenditures on health is believed to have direct effect on the availability of health care facilities, and consequently expected to have inverse relation with mortality rate and direct relation with the life expectancy at birth.

The expenditures on education by government are also expected to have the same sort of relation with the indicators of level of health as government expenditure on health, that is, because the extent to which a nation has devoted resources to education is thought to be an important influence on health status, since the more highly educated a population is, the greater the likelihood that public health education programmes will be successful, and therefore, the levels of mortality will be lower, and the levels of life expectancy higher.

Because of the great dependency of the less developed countries on agriculture in general, the expected relation between the indicators of level of health and indicators of government expenditures on agriculture is expected to be inverse in the case of mortality rate and direct in the case of the life expectancy at birth.

1.3 STUDY DESIGN

The design of the present study and the order of the chapters shows the approach which is taken. By going through each chapter, the reader becomes familiar with the approach and also with the final object of the study which is the introduction of mathematical models. The whole process is prologued by a theoretical introduction composed of three chapters.

In these three chapters the basic theory behind the introduction of the final model is explained. That is, in chapter two, the need for doing comparative studies is discussed, especially, a comparative focus on the national health systems has been neglected for a long time. The latest tendency in cross-national studies is toward the discovery of common solutions to common problems, something that is especially applicable to the health sector.

In chapter three, we have presented an analysis of the literature of comparative health systems, using a typology by level of analysis and units of observations. The chapter also analyses some of the ideologies about the study of national health systems and their relationships to the model of health organisation and to economic development. We also present a causal model for the analysis of health systems, based on the relationships among factors in four different sub-systems or "open linked system".

In chapter four the theoretical relationship between factors from four different sub-systems is discussed. These relationships are mostly based on analysis from developed countries, we tried to link these relationships with those which we believe to exist in developing countries. Accordingly, some variables have been chosen, to be included in the statistical analysis.

Three of the last four chapters have been devoted to analytical sections.

In chapter five, the methodology used for the analytical part is discussed.

In chapter six the behaviour of variables towards the indicators of level of health is investigated. In this respect it was established that there exists some discrepancy between the result obtained from our analyses and those done for the developed world. For example, Fraser (1973) has proved that there is a reverse and strong relationship between indications of the level of health presented by infant mortality rate and the variables representing the health services facilities indicated by the number of hospital beds per 1000 of population. In our study we established that this relationship does not exist in the less developed world. Notice must be taken that in this study indications of the level of health are presented by mortality rate and life expectancy at birth, and not the infant mortality as in Fraser's study.

In chapter seven, based on the multiple regression analysis, an attempt is made to produce the mathematical models to enable the policy markers to predict the future value of mortality rate and life expectancy at birth. These models are believed to be the only ones developed so far, which contribute towards the originality of the study.

In the final chapter the main research issues of the study are discussed. These main issues are; the build-up of the theoretical model, the relationships between indicators of the level of health, and those indicators which are believed to determine this level, and finally, the mathematical models. Also, in this chapter, the need for doing further studies is discussed.

This is a comparative study in the health field. It is offered as a contribution to the social science inquiry into health care system and the factors surrounding it. More specifically, it is a study of the factors outside and inside the health system and their affect on the health system and healthiness of some of the selected African developing countries.

The originality of the present study is the use of both comparative and systems analysis, in reference to the countries involved in the study and factors being analysed.

The terms "factor", "variable", and "indicator" are obviously value-loaded, but for our purposes, we have decided to use them interchangably, meaning that whenever these terms are used the meaning is the same.

Finally, throughout the study, for the sake of simplicity the name of the countries involved have not been given in full, that is, for example, instead of the United Republic of Tanzania, "Tanzania" has been used.

1.4 SUMMARY

There have been, and there will be endless debates and arguments on the way in which the healthiness of nations can be improved. There are countless theories about organising health services, but there is still little concrete evidence on the nature of the relationships between health and the factors which may be thought to determine it. Consequently, there are not enough models to enable policy makers to predict the future level of the health of a nation.

This is a comparative study in the health field. It is offered as a contribution to the social science inquiry into the health care system and the factors surrounding it. More specifically, it is a study of the factors outside and inside the health system and their affect on the health system and healthiness of some of the selected African developing countries.

The health system is considered as an open system in the sense that it is not independent of external factors. Possibly, it is the reverse. The sub system of health is heavily dependent on demographic, social, political, economic, and environmental factors that are shaping it. Accordingly, four sub-systems are differentiated and some factors, which are believed to have an affect on the healthiness of African developing countries, have been selected. These factors, then are used for further analysis and model building.

The countries involved in the study are: Republic of Botswana, Republic of Kenya, Mauritius (excluding the Island of Rodrigues), Federal Republic of Nigeria, Kingdom of Swaziland, and the United Republic of

Tanzania (excluding the Island of Zanzibar).

The originality of the present study is the use of both comparative and system analysis, in reference to the countries involved in the study and factors being analysed.

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PART ONE

A MODEL FOR THE ANAYSIS OF NATIONAL HEALTH SYSTEMS

CHAPTER TWO : COMPARISON OF HEALTH SYSTEMS AND ASSOCIATED THEORETICAL MODELS

CHAPTER TWO

COMPARISON OF HEALTH SYSTEMS AND ASSOCIATED THEORETICAL MODELS

2.1 INTRODUCTION

In this chapter, the need for undertaking comparative studies is discussed. To this end, the level of analysis and also the unit of observation have been reviewed. The decision for choosing the proper level and unit of observation suitable for this study is then established.

2.2 CROSS-NATIONAL RESEARCH IN THE HEALTH SECTOR

2.2.1 The Aims of Cross National Research

Social Sciences in their origins stressed comparative studies, something that was underemphasised during the long fight of these disciplines for institutionalisation in academia. In some sense we are witnessing a new revival of comparative studies in almost all fields of social sciences. In the opinion of W. Bell: "the comparison of different cultures and societies is essential for any proper and adequate study of man and his institution" (Bell 1971). The health field was no exception to this pattern, as Rokkan put it "health research has attained a higher level of international standardisation in codified terminology, classifications of causes of death, morbidity standards, etc" (Rokkan 1968).

In comparative studies we are more at the stage of accumulating data than of theory- building. This stage requires not only the collaboration of behavioural, social, and political scientists, as well as experts in causal modeling, planning, computers and econometrics, but also the use of different methods and data. Linz (1969) has discussed the combination of sociological data and methods with survey research in cross-national studies. Parsons (1971) has gone further, distinguishing two types of comparative studies: the "similarity and difference" approach, and the "system" approach.

Three tasks of comparative studies of health systems are: (a) to study differences between systems; (b) to analyse relationships betwen variables; and (c) to create theory about health structure and health systems and to integrate it into sociological theory. Cross-national comparisons may also include the study of different societies as well as the study of their different sub-systems at the same point in time., and the comparison of the same society at different times (as if it were, infact, different societies).[1]

Cross-national research in the social sciences has been mainly developed by political scientists, and most of its methodological literature is presently within the field of political science. Political scientists have also stressed not only differences between nations, but analysis within nations (Rakkan 1968). Allardt for example, considers that "studies of regional imbalances are important for cross-national studies, and partly because the countries with regional imbalances constitute exceptionally difficult cases in cross-national analysis" (Allardt 1966). Consequently, one of the most important goals of comparative studies has been to study variation within nations, and to try to link such variations with analyses of differences across nations.

In our study, we emphasise cross-national studies rather than "regional" studies, mainly because our prime interest is comparing the level of health in developing countries and conducting an analysis which would help to develop a framework for policy-formulation in the countries concerned.

Referring to the aim of the cross-national analysis, De-Miguel (1975), has differentiated between two levels of analysis: (a) Micro-level: the replication of an hypothesis in a different setting from which it was originally tested. After the testing of one proposition among different .... and diverse .... units of observation, its generality can be established. Micro-analysis looks mainly at individual variables, roles, attitudes, survey data, etc. (b) Macro-level: the study of a structural context, measuring the relationships among elements (or sub-systems) and testing hypothesis about influences between sub-systems and factors. Macro-analysis is concerned more with aggregate data, interdisciplinary work, the study of superstructural conditions, the analysis of political, social, and economic structures, and so on. The unit of observation is commonly the whole society, although it is possible to find valuable Macro-analysis of smaller units (i.e. a hospital, an organisation, a community). The over-concern of macro-analysis with society as the unit of observation has been pointed out by Vallier; "This preoccupation stems from an assumption that the total society is the most signficant of human collectivities" (Vallier 1971). However, following De-Miguel's reasoning, we accept that "macro-and micro-are appropriate terms for descriptive purposes when attention is directed to the level of social scope that is particular to a given structure, but the distinction is not helpful in dealing with the features of structural phenomena per se". We have an operative definition, and some studies are on the borderline between both approaches (micro- and macro-), or even include both scopes (micro-macro). For example, Eckstein (1958-1960) has dealt with the political intricacies of health services, tracing the history and analysing both the British Health services (1958) and the British Medical Association (1960). Other examples are Caudill (1958a), Dulf and Hollingshead (1968). Hollingshead and Redich (1958) and Myers and Bean (1968).

If we try to classify comparative studies according to their level of analysis (macro- and micro-), and their scope, or units of observation (within units and between units) we should construct the typology shown in table 2.1. In addition, it would be possible to broadly differentiate the data we are using (primary or secondary) and the concrete units of observation in each of the four cells (A, B, C and D).

By within and between we mean what is known as intra-societal and cross- societal (or intranational and international) studies. In their plurinational

Table 2.1

TYPOLOGY OF CROSS-NATIONAL STUDIES ACCORDING TO LEVEL OF ANALYSIS AND UNITS OF OBSERVATION

LEVEL OF ANALYSIS	UNITS OF OBSERVATION	
	WITHIN	BETWEEN
MICRO	A	B
MACRO	C	D

Source: See text

research, Hopkins and Wallerstein (1967) have distinguished between "cross-national", "multi-national", and "international" studies. These categories are mainly in the group of between-analysis, ranging from the most micro- to the most macro- type of research. The use of within and between passes over the problem of referring to society as the only minimum unit for macro-analysis, which is of special importance in comparative health systems studies.

The ultimate aim of comparative research is to develop appropriate Macro-analysis between-nations (group D). Unfortunately the majority of cross-national studies have been done at a "lower" level of analysis. Thus, there is no reason that one study should belong in its totality to only one of the four types, although, in general, they do so. For example, in Field's study of the Soviet Union health system he analyses society and ideology as well as appraising the organisation, use, and distribution of health services. (Field 1967).

According to Merritt (1970) the organisation of cross-national research about health is much weaker than political cross-national research. In the health field there is nothing comparable to the World Data Analysis Programme (formerly the Political Data Programme), or the Human Relation Area files. This calls for a need to develop a structure for basic research and data, data banks, and so on. The World Health Organisation has been compiling these types of data for the last four decades or so, but it still has a long way to go. In the United States, the Medical Library of the NIMH (National Institute of Mental Health (US)) accomplishes some of these tasks. Nevertheless, as Mechanic says, "Comparisons across countries are confounded by the tremendous cultural, social and economic differences between one social system and another".

The types A and C (See table 2.1) are usually considered to be cross-regional studies, and B and D are the proper cross-national studies. General influences from A to B, or C to D can be accused of falling into the ecological fallacy. Also, diverse units of observations (for example regions) may give different results. Consequently any macro-study (C or D) should take this problem into account and fully specify the size and structure of its units of observation.

Now that we have established the direction of this study (type D), we should shed light on what are considered to be the health problems.

2.2.2 Cross- National Research on Health Field

Health is a state of complete physical, mental and social well being, and not merely the absence of disease or infirmity. As Coe suggested, the World Health Organisation's definition of health "indeed requires a conception of medicine as a social science" (Coe 1970). Seham, among many others, has expressed a similar opinion, "medicine today has come to be recognised as a social science dependent upon many non-medical disciplines if it is to line up to its full potentialities" (Seham 1969). This does not necessarily mean that health is equally understood in every country. As Elling explains "Health as a goal will be viewed quite differently in the technologically 'less developed' societies from health as seen in the "advanced" societies. In the latter, it may well be seen as a matter of consumption for welfare purposes. In the 'less developed' societies, health services may be seen as wealth creating". (Elling 1971). The importance of social factors in health problems was already stressed in 1847 by Neumann, and later by Virchaw in his dictum: "Medicine is a social science, and politics nothing but medicine on a grand scale". (Rosen 1963). Cross-national research on health matters has tended to be included within "medical sociology", a term used by Sand (1935). A sociological definition is also expressed by the conception of a health system as a functional prerequisite for the survival of any society. This approach has been developed by Mabry (1971), Field (1973a) and, Parsons (1971). The goals of cross-national studies of health systems were described by Weinerman (1971). And the final conclusion benefiting from the cross-national studies is a model with the following properties:

(a) to rationalise the existing health service systems in relation to the values and resources of the society.

(b) to provide for flexible adaptation to changing human needs and scientific potentialities,

(c) to establish appropriate priorities for the health service sub-system in the overall national content, and

(d) to expedite the transformation of knowledge and resources to health values through the intervention of health services of optimum effectiveness and efficiency.

This model is fully applicable to democratic politics, but Weinerman's goals are not those of countries in which the political system employs health mainly as an instrument of social control rather than as a set of social processes for the realisation of human beings and the appropriate employment of human energy.

Fry believes that: Comparative health systems ... as a field or discipline ... include the analysis of health organisation, health factors, and health processes; both within and between nations. Only by taking into accounts many different cases is it possible to establish a non-biased theory" (Fry 1969). Consequently such an approach may give us the opportunity of constructing a broader and more complete theory about health. The underlying question of any comparative study of health systems is the existence of a health system "superior" to all others, "that can be copied, adapted, and reinforced to match local and national patterns" (Fry 1969). However, very few cross-national studies of health matters have dealt directly with the difficult goal of appraising or measuring the efficiency and effectiveness of a health systems and thus the main question of comparative health systems remains unanswered.[2]

Since, in the present study, we have adapted the operative definition of micro- and macro- analysis of health system, for the sake of clarity, we have found it useful to repeat these definitions:

Micro-analysis tends to stress studies of the health behaviour of individual patients, population and small groups, analyses of family attitudes and reactions, reaction to health problems, studies of roles and the medical professions and many other relationships between single variables.

Macro-analysis focuses on the interrelationship among socio-economic factors and health, studies of structures and processes in the social system, the importance of health economics and planning in the development of society, the relationships of medical associations and institutions to the whole community, and so on.[3]

De Miguel has summarised some of the major studies of comparative health systems. He differentiates between them by the level of analysis (micro-, macro, and micro-macro) and the scope of units of observation (within nations, and between nations). De Miguel explains that some of the studies are on the borderline of two types and that others may even include two or three of the perspectives (De Miguel 1975).

According to De Miguel, Micro-macro- between type of studies is gaining importance while other types are losing importance, especially micro-within comparative analyses.

2.3 PROBLEMS IN THE STUDY OF NATIONAL HEALTH SYSTEMS

Available works in the cross-national study of Health Systems are not adequate. There are many reasons for not doing these kind of studies. The main ones are explained by Elling as follows:

> ...When I discussed the lack of any centre or network of centres for cross-national studies of health systems with high officials in WHO in 1973, I was told of at least two bad reasons why such work has been difficult within the context of WHO. First, for a long time, so the official said, the Soviets felt that their system was the only one which made sense, thus, from their point of view, it was not a question of studying different systems, but one of adopting the Soviet system. Second, he said, true scientific comparisons of health systems are difficult within the context of WHO because the ministeries of health in most countries, particularly "developing" countries, do not want to be involved in comparisons which might place them in an invidious position.
>
> R.H. Elling (cross-national study of Health Systems - political - economic and care) Transaction Book. New Bronswick USA. 1980. p.231.

Among the good or at least legitimate reasons for there being less cross-national studies of health systems than one might wish are the difficulties of obtaining adequate data, (see Chapter Three) the lack of adequate frameworks for making cross-national comparison and contrasts of health conditions and service systems.

Perhaps the most important good reason for not conducting cross-national studies of health systems is what has been termed as the "non-transferability" principle. But there appear to be limits to this "non-transferability" principle which support the belief of why cross-national studies of health systems ought to and will grow. Perhaps the most important reasoning is that we have no other way of "knowing" and anticipating and taking part in the development of our own future than by making comparisons.[4]

Cross-national biases can be summarised as: a) the study of only English-speaking societies; b) the analysis of only developed countries; and c) the lack of research on internal or regional differences.

Attention has been given massively to Western European Countries, the United States, and very few others. The lack of knowledge about developing (or simply unfashionable) countries is striking. During the last three or four decades many of the "universal" generalisations of medical socialology were extracted from the study of a few selected countries. Great emphasis has been placed on a few concrete health systems, particularly those of the United States.[5]

People like Gemmill (1960), Lindsay (1962), Eckstein (1958), and Mechanic (1972) have written books about the United Kingdom.

The Soviet Union is another country which has attracted research, and a great deal of material has been produced in this respect.[6]

Others such as Anderson (1972a), and Birdck (1964), and Anderson, Smedby and Anderson (1970), have also carried out studies on Sweden and other Scandinavian countries, New Zealand, and so on. In fact the persistent tendency to compare the health systems of the United States, the United Kingdom, and the Soviet Union is not unreasonable if we recall that they are presenting three different systems of organising health services.

There has been a hesitancy about deciding which systems work better than others and why. The ideology is that, generally speaking, all health systems are valuable.[7] Cross-national studies on health care systems have carefully avoided the conclusion that one system might be better than another. It has been thought that this is primarily due to the way the topic was approached and/or the value-free scientific method, but it may equally be due to ideological premises.

At present with some exceptions,[8] very little is known of other countries, especially developing countries. This is one of the most important problems of research in comparative health systems. Even the limited available research contains certain difficulties.

One of the consequences of these research studies is, that frequently the mortality indicators have been de-emphasised, while higher stress has been placed on more "relevant" indicators, such as satisfaction, happiness and psychosomatic symptoms. Consequently these indicators have no real meaning for almost 90 per cent of the countries of the world. This clearly highlights the need for a more detailed study of developing countries.

Comparison between nations are sometimes merely apparent.

Many reports only put together different and separate descriptive case studies, not using comparative analyses. Furthermore, the framework used in these studies are varied. The studies are rarely analytical, but more often descriptive or even anecdotal, frequently systems are described as defective or as abnormal. In consequence cross-national studies of health matters have found highly mystifying variations from country-to-country, which often are impossible to explain.

The present situation is also indirectly linked to a lack of reliable data. Lazarsfelld (1955) and Coleman (1964), among others, have pointed out that the most important variables in the social sciences are those for which we have fewer data and/or indicators. The case of "health" is an example of this pattern. Empirical research into the health system is rather new, and consequently the toolbox of theories and data that we have today is minimal. But we should not fall in the trap of believing that lack of data is the most important problem, it is even more significant to establish <u>who</u> uses the data and <u>how</u>; what should always be analysed is the result and implementation (or application of the result). It is not surprising to find that those countries that need the information most are also those that do not have the information. Therefore, bearing in mind the above mentioned points, we set to further our knowledge by undertaking a comparitive research for the most needed countries, i.e., African developing countries.

2.4 SUMMARY

We are witnesses of the revival of comparative studies in recent years after having been neglected for several decades. In the thirties and forties there were several examples of excellent comparative analyses of health sectors (for example, see: Newsholme and Kingsbury (1933), Newman (1939), and Roemer, M.I. (1948)). Nevertheless, the present studies have a different focus, and use different methods of research to those of earlier years.

To better define our work we present a typology of cross-cultural studies, taking into account the level of analysis (micro- and macro) and the limits of observation (within and between).

We also present a description of the most important problem in the study of national health systems, and their probable impact on a study such as this one. Finally, we suggest different research techniques - which are applied in this study - to avoid such methodological problems. The most notable problem in this field is the concentration of studies about the health systems in Anglo-Saxon and/or developed countries. This has introduced several biases in the interpretation of the comparative health literature and its inferences. Our present study avoids this problem by investigating developing countries, choosing the African developing countries as the focus of the analysis.

In brief, the present study of six countries (Republic of Botswana, Republic of Kenya, Mauritius, Repuglic of Nigeria, Kingdom of Swaziland, and United Republic of Tanzania) can be considered at a macro-level as well as a between-nations analysis (type D in the typology), as it includes cross-national research of health systems. In the comparative health literature this type of analysis is of increasing importance especially for developing countries, which are substituting their old health structure for more efficient and economical ones. The analysis of the comparative health typology explains the relevance of the present study and its theoretical raison-d'etre.

2.5 FOOTNOTES TO CHAPTER TWO

1. This can also be ordered with a "systemic" approach, as Bice and White have suggested: "In cross-national comparative utilization research we are concerned with 1) describing or explaining Volumes and/or reasons for entries, patterns of flow, or types of outcomes within at least two nations and 2) comparing these across the nations". Bice+White (1971).

2. One exception among these few is Cochran's study (1972) on the effectiveness and efficiency of the British National Health Service.

3. A basic understanding of micro-macro approach appears in Rokkan et al (1970).

4. There is a more dynamic, dialetic way of viewing the problem of knowing. This is knowing through doing. In working with our material and social reality to create the future, we will come to know it. Nevertheless, work on the future can be valuably informed by comparative studies of different national experiences.

5. Some examples of these works are: Stevens (1971), Ehreneich and Ehreneich (1970), Hilleboe, Barkhuus and thomas (1972), Somers and Somers (1961), Elling (ed) (1971), and Collings (1950) along with some others.

6. Scholarssuch as Popov (1971), Gordon Hyde (1974), Sigerist (1937, 1947), Fry (1969) and Field (1957, 1967, 1973b), Navarrov (1977) have carried out studies on the Soviet Union.

7. This has been (and will be) the policy of the World Health Organisation in order to avoid serious political problems that would challenge the survival of the institution.

8. Some of these exceptions are: Weinerman (1969), Bryant (1969), Taylor (1968), Blum and Blum (1965), Myrdal (1968), Hall (1969),Maxwell W.E. (1975), Segall M. (1977), Gish and Walker (1977).

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CHAPTER THREE : THE CONCEPTUAL FRAMEWORK OF HEALTH SYSTEMS

CHAPTER THREE

THE CONCEPTUAL FRAMEWORK OF HEALTH SYSTEMS

3.1 INTRODUCTION

The conceptual framework of Health Systems is basically the understanding and application of Systems Concepts in the field of health management. In this chapter, Systems Concepts is introduced and the relevance of applying it to problem structuring and solving for health management is discussed. Indeed, it is within this conceptual framework that the contextual framework of any model development has to be perceived for such models to be effective and efficient.

Thus in this chapter, categorisation of systems and the manner in which systems analysis needs to be conducted for health systems will be the focus of attention. Furthermore, the relationships between "health system" and other systems are explained. Variables (factors) influencing health systems and the degree of influence are determined.

3.2 THE SYSTEMS CONCEPT

Ackoff (1971) defines a system[1] as a 'wholistic' set of interrelated elements. Literally, a system is a plan or scheme according to which things are connected into a whole. The Systems Concept however emphasises five basic considerations to be bourne in mind when analysing any system. These are:

- the total system objectives and, more specifically, the performances of the whole system;
- the system environment, which defines the system's boundaries and imposes a set of fixed constraints on the system;
- the resources of the system;
- the components of the system, their activities, goals and measures of performance; and finally;
- the management of the system.

Based on the above considerations, a system can be defined as a set of interrelated elements, connected together in an organised manner. Indeed, the 'Weltanshaun' (or world-view) of any system is dependent on the nature of the system and on the type and mode of interaction it is capable of sustaining. Thus, systems can be categorised on the basis of their boundaries and also on the basis of the type and mode of interactions sustainable. The first form of categorisation identifies 'closed' and 'open' systems, while the second identifies 'purposive' and 'purposeful' systems.

3.2.1 Closed Systems

Closed Systems are those which are organised in such a way as to be perceived to be self-contained - that is, the organisation of the system is perceived to be sufficiently independent so that its problems could be analysed in terms of internal structure, tasks and formal relationships without reference to the external environment.

A characteristic of all closed systems is that they have an inherent tendency to move towards a static equilibirum and entropy - that is, the tendency to move towards a chaotic or random state in which there is no further potential for energy transformation or work. Thus, the salient feature of any closed system is its inherent randomness of organisation and lack of patterning.

3.3.2 Open Systems

Open systems are ganised in such a way that dynamic relationships are maintained both within as well as with the environment.[2] The openness of the system to its environment allows the receipt of inputs in the form of materials, energy and information which are used to offset the process of entropy.

Thus, the open system adapts to its environment by changing the structure and processes of its internal components. In the continuous interacting with its environment, such a system continuously strives to achieve a 'steady state' or dynamic equilibrium and continuously sustains its capacity for work or energy transformation. Indeed, the survival or viability of the system would not be possible without the continuity of inflow, energy transformation and outflows. The system must receive sufficient inputs of resources to maintain its operations for resource transformation, and the system must export the transformed resources to the environment in sufficient quantity to continue the viability cycle.

3.2.3 Levels of Recursion

Regulation is central to the understanding of problematic situations in an organisational context - that is, when there is a perception that relevant situations are at present (or are likely to be in the future) out of control. Implicit in the development of regulatory processes is the assumption that the decision-makers concerned have in their minds tacit or explicit definitions of performance variables as well as the criteria of stability or acceptable variability for the processes. Regulation would be meaningless, however, without identifying the relevant transformations prevalent in the system. The identification of relevant transformations defines the system's boundary and makes the results of the transformations meaningful. In doing this however, performance evaluation and monitoring parameters which are expected to be applied have to be identified at each particular level of aggregation. Thus various system or subsystem boundaries can be identified depending on the distinctive levels of aggregation perceived. Such levels of aggregation are the levels of recursion referred to in systems' terms.

Applying this to Health Systems for example, the highest level of recursion is that at which the World Health Organisation (WHO) obtained the multi-national policy consensus of "Health for All by the Year 2000". At that 'meta' level, the participant-nations recognised and accepted a desired state of health to be achieved by the end of the century. The means for achieving that state however has to be determined at the immediate lower level of recursion - that at which the various governments concerned prioritise their goals and set fiscal policies depending on the socio-economic, political and cultural situations faced.

The next lower level of recursion is that at which the Ministry of Health in each country develops the strategic plans for health management and sets policies accordingly. The still lower level of recursion after the

Ministerial level is that at which the various health institutions in each country appraise material and manpower resource plans and develop the tactical plans for policy implementation within the prevailing budgetary and other constraints.

Thus, levels of recursion represent the levels of hierarchy of systems or subsystems at which the various relevant boundaries are defined and which in totality constitute the framework for overall policy formulation and implementation.

3.2.4 Understanding the type and mode of interaction

On the basis of type and mode of interaction in systems, the two distinctive categories are 'purposive' and purposeful' systems.

Purposive systems are multi-goal seeking[3] but with the different goals having a common property. Indeed, the purpose of such a system is to sustain that common property and for this, the system selects the means to pursue any specified goal. The characteristic feature of any purposive system however, is that although such a system can pursue different goals, albeit of a common property, the goal is not self-determined - it has to be determined by the initiating event.

Purposeful systems on the other hand can pursue different goals which may or may not have a common property. Furthermore, such a system determines the goal to be pursued, albeit under constant conditions. A purposeful system can produce the same outcome in different ways in the same (internal or external) state and can produce different outcomes in the same and different states. Indeed, the characteristic feature of any purposeful system is the display of will in that such a system selects the ends as well as the means.

It must be emphasised at this stage that the above categorisation of systems mainly reflects the structural network that might be expected within the system - such a categorisation reflects the degree of effectiveness achievable by the system. What is not immediately clear is the degree of efficiency achievable - that is, the mode of responses that the system is capable of sustaining.

The distinctive mode of responses identifiable in systems are 'homeostatic', 'mediative' and 'proactive'. Homeostatic response is that which is geared towards the achievement of internal stability. Mediative response is that which is geared towards adaptation to the environment - that is, a system develops this mode at the initiation of an external stimulus. Proactive response however is that through which a system demonstrates the initiative to affect the environment rather than vice versa.

Thus a purposive system can only sustain homeostatic and mediative responses. On the other hand, not only can a purposeful system sustain all the three modes of response but more importantly, the proactive response is most likely to play the most significant role.

Relating the above considerations to health systems, it is not difficult to realise that there is a considerable gulf between health systems in LDCs (Less Developed Countries) and health systems in developed economies. Indeed, it can be said that health systems in LDCs are closed and purposive, while in developed economies they are open and purposeful. This is evidenced by the success of, for example, immunisation policies to combat killer-diseases in LDCs. Even the Alma-Ata declaration of "Health for All by the Year 2000" can be considered as evidence of the proactive response of health systems in developed economies.

3.3 INVESTIGATIONS INTO THE HEALTH SYSTEMS RESEARCH

3.3.1 The Concept of Health Systems

Health can be considered both as a source of energy and a basic resource.[4] "Health System" may signify several things: the expression "health industry" is often used as a synonym (although not very accurately); also the health system is viewed as a system of power relationships (Anderson and Kravits, 1968); a matter of pressure group politics (Eckstein 1960); a system of social control; (Twaddle, 1974)[5] a scientific bio-medical setting; or a problem of allocation of resources. All these conceptions are included, at different levels, in the general picture of the "health system". They have in common that everything centres on the human being; he is part of the input, the object of the transforming processes, and the goal of the output. Finally, human beings are both patients and doctors.

Up to now we have used the term "health system" without specifying its content.[6] It is possible to summarise the most important notions of "health system" from the most narrow to the most broad, thus obtaining an accurate imagery of it. Several studies identify "health system" with "health services system", phrases which are frequently interchanged. The way we employ the term here, the health system is something more than merely health services; it includes the medical profession, planning and implementation of health policies, payment system, preventative medicine, medical teaching and research, health education of the population, health bureaucracies, health ideologies, and so on. A common definition of this broader notion can be found in Bice and

White: "Personnel and facilities which are organised in order that specialised knowledge and skills can be applied to individuals, collectivities of individuals, or their environment for purposes of promoting, protecting or restoring their health". (Bice and White 1971).[7] The workshop proceedings on International Studies of Medical Care (Asilmore, California : August 1969) defined the national health services system as : "the organisation, distribution and lay use of socially or legally sanctioned personnel, facilities and equipment which are employed in preventative actions for, and the rehabilitation and treatment of, persons who have departed from physical emotional or social well-being, or who are at risk of doing so". (Cited in Mabry 1971). The definition of "health system" used by Mark G Field is still broader, "that societal mechanism which transforms generalised resources or inputs (mandate, knowledge, personnel and resources) into specified outputs in the form of health services at the health problems of the society" (Field 1973a). This includes all kinds of institutions, activities, and efforts of a society related to the health of its people.

This concept is very close to "health services systems" as it was usually employed by Weinerman: "all of the activities of a society which are designed to protect or restore health, whether directed to the individual, the community, or the environment"[8] (Weinerman 1971).

Our own definition deduced from the general definition of "health system" for further use is as follows:

A "health system" is the set of relationships among institutions, social groups, and individuals that is directed towards maintaining and improving the health status of a certain human population.[9] This includes, needless to say, not only factual but ideological relationships.

Having established the definition of health system, we shall now proceed to define the concept of the system as a whole. "System" in our definition is as it is considered in the tradition of the systems analysis or systems approach.[10] According to Mervyn Susser, a system is "a set or assembly of factors connected with each other in some form of coherent relationships. A system is an abstraction" (Susser 1973). The health system (as a social system; Parsons 1951) can be considered both structure and process. The main function of the health system is to transform inputs into outputs. Inputs are scarce, and we want certain outputs and not others.[11] Feedback in a systems approach is considered as the effect that processes and outputs may have on future inputs.

This idea is emphasised by Kleczkowski, et al as:

> any society can be analysed in terms of a number of interconnected systems. For example, agriculture, transport, and industry. The health system is usually one of the more complicated of these entities, its development having taken place slowly over the centuries, with inputs from people's beliefs, science, commercial factors, and other social forces. Usually without any deliberation or systematic planning. Moreover, if one considers all the social and environmental factor that may contribute to or influence health status, one finds the close relationships between the health system and many other systems - agriculture, industry, education.
>
> K Bodan, M Kleczkowski, Milton I Roeomer, and Albert Van Der Worff, National Health Systems and their reorientation towards health for all - Evidence for policy

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The definition of a system includes the delimitation of inside factors and of those which are operatively considered as external forces. Then the latter group is excluded from the analysis, although its existance is often reconsidered. In this sense a system is an operative definition of a sphere of relationship, trying to minimize internal inputs and outputs. Consequently a systems approach stresses the relationships of structures and the interdependence among factors. The goal of systems analysis, in any field, is to build a model and then to measure how close it is to the real system.[12]

3.3.2 Health Systems as Open Systems

The problems of conceptualisation and measurement of health systems are greater than that of physical systems (Anderson 1972a). As Hedinger says, "The open system approach seems particularly well suited to the study of health services delivery in light of the unusually complex nature of these services which are provided by a great many disparate groups of people organised in exceedingly complicated relationships" (Hedinger 1969). The health organisation works as an open system in which the output, the health status of the population, reactivates the system, being in itself part of the new input.[13] This can be seen in Figure 3.1 where we have adopted Weinerman's model of the relationships in the development of health services systems (Weinerman 1971).

The scheme of an ideal comparative study of health systems

Figure 3.1: Relationships in the development of health services system

Source: WEINERMAN, G.R. "Research on comparative health service system" Medical Care 9 should be summarised as follows[14]:

(a) INPUTS : These are the determinants of the system, including the study of different health care organisations, use of resources, planning, implementation, decision-making mechanisms, controls, etc.

(b) PROCESSES : These are interactions between the different factors of the system, including relationships between health services and health status of the population and the distribution of health delivery systems. They can be approached by analysising within unit (De Miquel classification) differences of variables such as region, sex, social class, income, education, age, occupation, ethnicity - race, and so on.

(c) OUTPUTS : These are consequences of the system, and include the health status of the population from a biological, medical, and sociological point of view ; and medical ideologies, knowledge, attitudes, and practice of population related to health matters as outcomes of the given structure and of the medical profession.

(d) EVALUATION : A summary would include the assessment of the effectiveness, efficiency, and adequacy of health services systems in terms of their explicit goals, such as the attainment of the equality principle; the analysis of relationships between health care system and health status of the population; and the study of alternatives and priorities in the health system.

According to Wagner the organisational object of a health system is "to provide the highest level of health care to the greatest number of people at the least possible cost" (Wagner 1966). This means to maximise the quantity of health care, to maximise the number of people using the system, to maximise the condition of life and to maximise the quality of care, and to minimise cost. (Wagner 1966). Another important object implicit in the definition is the "equality principle", meaning, among other things, equality of access to health services. The goal of a health system has been stated as <u>ONE OPEN SYSTEM PROVIDING EQUAL ACCESS TO THE HIGHEST QUALITY OF HEALTH CARE FOR ALL CITIZENS IN A GIVEN AREA OR NATION,</u>[15] or even better, for all residence of an area.[16] Relative inequality seems to be part of every type of existing health organisation, whether it be a pluralistic, health insurance, health service, or even socialised system.[17]

Many of the variables influencing the health system (such as economic or cultural one) are not the only factors of it, but as Babson has properly noted, they are also "tools by means of which health care systems can be influenced". (Babson 1972), that is to say, independent variables.

The idea of control as it has already stated by Boguslaw (1965) suggest that the results of a system should be consistent with the expected values. The measures of the outputs of the health systems can be various. One may look at, among other things, the <u>effect</u> (results of some special actions); effectiveness or efficacy (the system is able to bring about the result intended); and efficiency (state or quality of being able to perform duties well).

The measure of effectiveness refers to the main question: Is the health system achieving the goals for which it was designed?[18] The World Health Organisation has defined the effectiveness of a health service as the measure of the extent to which that system is achieving its goals (WHO, 1969). But health planners, economists, and Sociologists have pointed out the necessity of increasing not only the effectiveness of health systems, but also their efficiency in order to meet the growing demand for medical care. This means achieving the previous goals with the least expenditure of resources (Manpower, equipment, budget, and so on). Efficiency is, in summary, the cost at which a given output is obtained (Blum et al, 1969). Nevertheless, without a certain universal goal comparisons between the intended goals of countries can be meaningless. Health plans should make clear those goals in terms of general equality, and a certain quality of care.

For the measurement of the functioning of a health system, we should look at least at the following features: (a) the ability of the system to produce the results planned or intended; (b) the ability of the system to perform its duties well, and with a relative maximum of quality; (c) the possibility of introducing the "equality principle" in all the different aspects and stages of health care; (d) the transformation of increase of inputs into proportional increases of outputs; and (e) the level to which the system controls itself or depends on external factors or decisions.

Health system researchers are conscious of the existence of a variety of alternative ways of obtaining a similar output. These can be called "policies" or "strategies". But it is also true that finally priorities are mainly based on value judgements and politics.[19] This is the reason why Morris has noted that "greater agreement on priorities is itself a priority" (Morris 1969).

3.3.3 A Causal Model for Health Systems

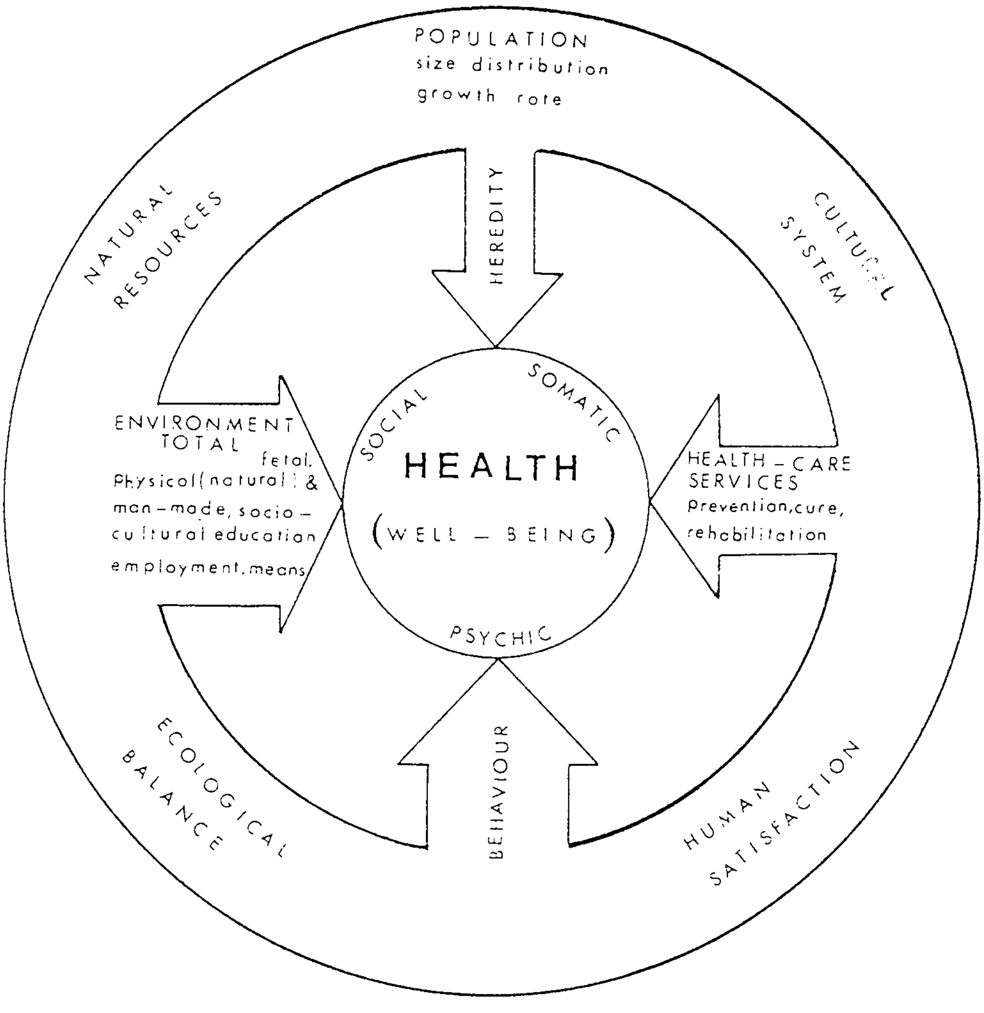
A model is a mechanism that "simulates" reality. Scepticism about a whole system approach is partially based on the difficulties in dealing with their study and application to reality. Bakett has pointed out that medical research has suffered from a notable absence of models (Bakett 1971).

Perhaps Blum's (1974) idea of input to health is the milestone of this study, his idea is summarised in Fig 3.2. He has developed the model to help health planners to become familiar with factors that affect health, Fig 3.2 shows that the probable relative importance of the four aggregates of forces that have the major effects on health care portrayed by the width of the four input arrows. Clearly the largest aggregate of forces resides in the person's environment. His own behaviour, in great part derived from his experiences with his environment, is seen as the next largest force affecting his health. Medical care services have been seggregated from the environment because of the great interest and investment on them. They make a modest contribution to health status. The contribution of heredity to state of health is harder to judge. Many hereditary attributes never come to fulfilment because of the omnipresent environmental and behavioural forces which act before many genetic forces come to maturity. Other hereditary attributes are, of course, increasingly being polliated by medical care.

The peripheral ring of the diagram makes the point that the four

Figure 3.2

INPUT TO HEALTH



Adopted from H.L. Blum; "Planning for health"
human sciences press 1974, 3

major forces are related to one another and affect one another through their mutual dependency on what might be called the key substracts, e.g., natural resources, ecological balance, population, cultural systems, and human satisfactions.

Our approach to causal modelling for health system tries to incorporate Elling's model (1980), developing some external factors.[20] Elling's concern is to identify health systems which offer evidence or promise of improving the health status of all the people of the nation.[21] Elling suggests that without population - based measures of health status and the intermediate goals, planning and organising for health will remain abstract and irrelevant to meeting the basic health needs of all the people.

Elling's demonstration of the major blocks of variables as related to health status and health services is shown in figure 3.3

The diagram is intended as a space-saving device for this brief coverage of major elements of a framework and possible relationships among them. Solid arrows indicate a supposed direction of major influence which broad Health Systems have or may come to have on environmental and life conditions. A second dotted arrow suggests that health systems may have some, but a lesser influence than life conditions (e.g., level of education) on sophistication of the population as to health problems and health services. Secondary influences are not shown for the interest of clarity.

Elling defines the health status (A1) in the broad WHO concept (already discussed) as the major objective or dependent variable of health

Figure 3.3. Major Blocks of Variables and Flow of Influence in Health Systems.

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Source: Elling R.H. 1980 Cross-national study of Health System, political, economies and health care, Transaction Books, New Brunswick (USA) and London UK systems. Certain secondary objectives or clusters of intervening variables (environmental and life conditions; sophistication regarding health and health services; satisfaction with care, timely entry into care, and logic of the core problem - i.e., A2-6) are seen as determining health status and as themselves determined by the other major blocks of variables. Thus the context (D) is seen as the basic conditioning set of variables determining environmental and life conditions, including the cultures and physical conditions of the populations which have in Elling's view a direct bearing on health. The context also influences the type of planning apparatus (C) which, in turn, influences the health care deliver structure (B). This has a bearing on the achievement of the secondary health objectives, satisfaction with care, timely entry and logic of the care process.

The causal model we present in the following pages is designed in a way to be applied to different societies and time periods. Therefore, it is formulated to be applied to both developed countries as well as developing countries, of which the latter are subject of the present study. The main goal ... or expected output ... of a health system is to improve the health status of the human population in some defined area. But "health status of the population" is somehow a vague term. If we want to measure outputs in relation to the inputs which we introduce into the system, it is necessary to make clear our objectives, with the maximum possible detail. There is a tendency to see the health status of a population as a fatalistic outcome of some external (and difficult to control) factors such as the social, economic, and political environments, and on this point the policies between (and even within) countries may vary.[22] In general, the intended output has been to improve the level of, and equality of distribution of the health status of a given population in a defined area. This principle was defined by Sigerist in the following terms : "All the people should have medical care, irrespective of race, creed, sex, or economic status, and irrespective of whether they live in town or country" (Sigerist 1944). Thus, the concept of health status includes both level and distribution of health.

The classic functions of a health system have been the following: prevention, prognosis, diagnosis, treatement, custody and rehabilitation of a given population. In addition to these, we can include the education of health professionals and the health education of the population. It seems true that the health systems of the world are growing more similar to each other, and that cultural factors are becoming less important than the level of economic development.[23] Nevertheless, a health system is still an open system in the sense that it is not independent of external factors, possibly it is the reverse. The subsystem of health is heavily dependent on demographic, social, political, economic, and environmental factors that are shaping it.

We, unlike some authors e.g. Bakett (1971), who pointed out that medical research has suffered from a notable absence of models, and also, those authors, who have divided health system into factors with only one level of analysis,[24] have taken into account different subsystems. The advantage of doing so is that, all ranges of variables and data can be included, from the most internal to the most external factors, in order to explain the whole health systems. These subsystems are arranged as follows:

SUBSYSTEM A   REPRESENTS INDIVIDUAL VARIABLES

SUBSYSTEM B   VARIABLES RELATED TO INSTITUTION

SUBSYSTEM C VARIABLES THAT REFER TO GLOBAL SOCIETY

SUBSYSTEM D VARIABLES THAT DEPEND ON LARGER SYSTEM

Within each subsystem we included factors (or sets of indicators).

SUBSYSTEM	FACTORS	
Individual(A)	Health Status	A1
	Biomedical Factors	A2
	Psychological Factors	A3
Institutions(B)	Health Services	B1
	Health Organisation	B2
	Health Planning	B3
Society (C)	Sociocultural Patterns	C1
	Political Structure	C2
	Socio-economic structure	C3
	Demographic Structure	C4
Larger System (D)	Environment	D1

The subsystems are shown in Figure 3.4. This is a three dimensional view of the subsystems. Although the figure shows a hierarchy of subsystems, the intention is not to show this in a hierarchical form. In order to understand the position of each subsystem, each quadrant is put on top of the other one, but the intended form is shown in Figure 3.8. In this figure all the subsystems are clustered around each other, with individual subsystems in the middle and the rest of subsystems around it accordingly.

These subsystems can be defined as follows:

3.3.3.1 The Individual Sub-System

Health Status (A1) is the dependent variable (or the outcome) of the health system. It can be measured by such indicators as mortality rate, morbidity, analysis of causes of death, positive mental health, etc.[25] The quoted definition of the World Health Organisation embraces a triple state of mental, social and physical well-being: "health status has to be looked at from the community as well as from the personal point of view, social well-being might therefore be regarded as a state of predisposing conditions of health" (W.H.O 1957). There are no limits to the health status of a population the term "health Status" may also fall within the labelling theory, and then "status" is understood in its sociological sense, as Twaddle clearly explains as a "kind of social label which can be attached to an individual and which defines to some extent how he is expected to behave and how others should behave towards him" (Twaddle 1974). This approach is rarely used in the comparative literature.

The biomedical factors (A2) are mainly related to the incidence of illness, while social factors are more related to the "prevalence" of illness. Biomedical factors include race, weight, height, biological inheritance, impairment, etc. They are linked to various deviation from the normal functioning of the body, influencing the present and/or future health status of an individual. One of the important facts of health

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Four level of recusion: Individual, institution, society, and larger system sub systems

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systems research (something forgotten) is that morbidity and mortality can not always be modified simply by a better health care organisation. In fact, the fantastic decline of mortality in some of the developed countries has not reduced illness, and some experts think that morbidity rates have probably increased.[26] But the former (mortality rate) may still be used as a relatively sufficient indicator to measure the health status of a developing nation (as it can be seen later in chapter four). The outputs are often inconsistent with the inputs and/or the explicit national goals of the planning procedures.

Psychological factors (A3) grow more important each day, due to their influence on the mental health status of the population of developed/and underdeveloped countries. There is an abundant bibliography on stress (or social stress) that supports this statement.[27] Social sociological measures of health as opposed to purely biomedical measures, include the ability to perform a social role, and such behavioural expressions as sickness, quality of life, positive mental health, happiness, and satisfaction, unmet needs for health care, and so on. The satisfaction with care includes all kind of analysis about expectations, costs, treatment procedures, and racial or religious segregation, etc. These analyses can be made at different levels and samples, such as the whole population, the politicians, planners, providers, the medical profession, patients and so on. Sociological studies of health systems apparently have not paid enough attention to these biomedical and psychological factors. Psychological variables have a strong influence on modern life, and we are living, according to some authors, in a "sick society". The individual subsystem as the first level of recursion is represented in graphical form in Figure 3.5. The quadrangle representing the whole subsystem and each quandrant

Figure 3.5

First level of recursion: Individual sub system

Source: See text

The sub-sub systems are clustered together to build up the individual sub system represent the sub-subsystem, the number of quadrants are not equal to the number of indicators mentioned earlier, there is room for more indicators if one ever needs to introduce them.

3.3.3.2 The Institutions Sub-System

Popov has defined health services (B1) as "all those personal and community services, including medical care, directed towards the protection and promotion of the health of the community" (Popov 1971). Health services are the institutionalised media for maintaining and restoring people's health. Health services are, consequently, institutions structured and designed to cure people; hospitals are no longer places where one is sent to die. Health services also include assessment of the quantity and quality of health equipment and health manpower, distribution of services, resources and supplies, accessibility of services, etc. The demand for health services depends largely on 1) technical and scientific levels of society., 2) Social and cultural values, and our awareness of them., and 3) the accessibility of resources. Therefore, the existence of health services is different from the use of health services. The barriers can be, among others, geographical, cultural, economic, educational or those of appropriate coordination of efforts. According to Anderson we may consider that "within very wide ranges there is no such entity as an adequate health service". (Anderson, 1967).

Sociological research about regional and rural-urban differences in health services is scarce. An accurate model for health systems should differentiate between Health Services Resource and Health Services Utilisation because both factors have different relation to other variables.

It is crucial to remark that health status depends on the utilization of health services and not on the availability of health services, a topic sometimes neglected in the literature. Paradoxically, some studies have demonstrated that health services have nothing to do with the health status of the population, and that socioeconomic level and other conditions of life are more crucial.

A similar health status of the population can be obtained through a different health organisation (B2). This is the "equifinality principle", which is to say that a system can obtain the same objectives from different initial conditions and by different paths (Kats and Kohn 1966). The present literature in the comparative health systems field has recognised that there are several ways of producing a similar output.[28] In general, "there is a growing convergence in medical care organisation in modern nations" a statement that has been repeated by many authors. (Mechanic 1974). Nevertheless, we are witnesses of a certain "cultural lag" between health technology advances and health organisations, a lag found in almost all countries.

The health organisation factor may include such indicators as : centralisation and structure of the decision-making processes, levels of the health organisation, institutional competition, fragmentation of services, regionalisation of services, coordination of tasks, coverages of the population, private practitioners, group practice and other forms of medical practice, channels of information and public understanding about health organisation, health education, and, among the most important, pre payment and/or insurance systems.

There are probably more books about health planning (B3) than there are actual health plans. In most countries, health planning is simply non-existent.[29] Even if it exists, the important aspect is the degree to which a given health plan is really implemented; and even if it is implemented, its efficacy and/or efficiency can be minimal. In the latter case, the effects of health planning on health status can be zero or even negative if such planning means unequal distribution of resources.

Among the problems that should be taken into account in health planning, sociologists are more interested in : 1) the analysis of health status and problems; 2) the inclusion in planning of basic general guidelines, and the coordination of planning with other sectors;[30] 3) the allocation of resources;[31] 4) the power to implement the plan, whether by suggestion or compulsion; 5) the presentation of alternatives and/or strategies; 6) the definition of priorities; 7) the methods for evaluating outputs; 8) the development of prevention and public health measures; and 9) the rigidity of planning. The first principle of health planning is to relate all factors of the health system to each other. This is illustrated by Sigerist's example.

> ... building hospitals in the Soviet Union is primarily a question of money, as it is in capitalistic countires. It is also a question of the amount of labour and bricks available.
>
> H.E. Sigerist "Socialised Medicine in
> Soviet Union. New York: Norton pp.14.

According to these ideas, health planning is not merely the allocation of resources and/or control, but the integration of health planning in other subsystems. Many times the term "health planning" is used for ex-post fact policies, based not on expert advice on planning but simply politically dictated. Hilleboe, et al have pointed that, "there has been a tendency in some less developed countries to start partly because it is fashionable and partly as a way of attracting foreign grants and loans" (Hilleboe, et all 1972). Many of these plans have had little if any effect on the health status of the population. The first and second level of recursion is presented in Figure 3.6. This figure represents the subsystems individual and insitution.

3.3.3.3 The Society Sub-System

Figure 3.7 shows the next level of recusion and the first two levels together, sociocultural patterns (C1) should not be neglected since they explain some of the variance in the health of a population that is not determined by purely economic or political factors. Mechanic (1968a) has suggested studying both the relationships between cultural content and cultural life styles and between definitions of health and responses to illness. On the other hand, Twaddle (1974) thinks that much of the variation in the appraisal of health status categories can be attributed to differences in how illness is defined by societies or even smaller groups. From a cultural point of view, the relativity of the concept of disease is most important. Caudill has affirmed that it is possible" at a certain point in society's history to die of a disease without ever being sanctioned as sick by the society itself" (Caudill 1953).

Cultural patterns are important in the way in which people perceive, react and respond to symptoms and/or illness. Among these sociocultural patterns, it is worthwhile to study values, attitudes, levels of

Figure 3.6

First and second level of recursion: Individual and institution sub systems.

Source: See text

Figure 3.7

First, second, and third level of recursion: Individual, institution, and society sub systems

Source: See text

education, personal hygiene, nutrition and sanitation patterns, religion, ideologies of the medical and paramedical professions, traditions, folk medicine, ethical considerations, social morbidity, and social isolation, and so on. Last but not least, social stratification is one of the most important variables in determination of the health status of a population. Elling says that the general principle is that "the social system of a society results in a different distribution of rewards, including health and health care"[32] (Elling 1971). The implicit hypothesis may be stated as, 'the availability of health services varies inversely with the need for it in a certain area and population'.

It is also a fact that health systems greatly depend upon the political structure (C2) of the society Field (1973a), and the power relationships between groups and institutions. (Elling 1968, Eckstein 1958; 1960, Ugalde 1972 ; 1973.) According to Lewis (1955) other variables that should be observed are : regime structure, concentration of authority and power, channels of power, decision-making processes, mass media structure, legal considerations of the political subsystem, role of elites and intelligentsia and local leadership structure.[33] Generally speaking, health status depends on the political structure through health organisation, payment systems, regional imbalances, etc.

It is almost automatic to link health status to economic development (C3)[34]. But we should be aware that this relationship is not always positive, for example, in such cases as veneral diseases, congenital malformations, lung cancer, poliomyelitis and cirrhosis of the liver. Nevertheless, it is still true that in the world "the chief cause of disease is poverty". (Sigerist 1938) In studies of health systems of developing and underdeveloped countries, it was discovered that in some areas of the world hospitals are still places where people go to die, that there are more doctors than nurses, that some health authorities stress native medicine, that cholera (among other illnesses) is endemic and that most of the population is not served by modern medicine. (Myrdal 1968). Economic development is usually measured by global indicators of goods and servies produced, capital resources, investment, etc, with limited attention to their distribution among members of the society and their consequences for the quality of life (food, clothing, housing, etc). Other indicators to take into account are, obviously economic resources, socioeconomic circumstances, financial structure, level and distribution of income and occupational structure.

The demographic structure (C4) has been traditionally linked to the health status of a population as both its cause and effect. Nonetheless there have been cases in which both the mortality rate and health status have decreased.[35] Among demographic factors, it is possible to distinguish between the demographic characteristics of the units of observation (generally speaking, nations, regions, area, cities), such as size, density, urbanisation, etc., and personnel variables, such as rates of divorce, age, sex, marital status, migration, illegitimacy, and so on. Except for extreme cases, the latter group has a stronger influence on health status.

3.3.3.4 Larger Systems as a Sub-System

The influence of environment (D1) on health status seems less important in post industrial societies than in underdeveloped or developing countries. If we distinguish between social and physical environment, then we can recognise that social environment plays an important role in the mental health status of a population. In addition, such factors as geographical structure, physical environment, climatic factors, etc. clearly affect physical health. Indicators such as housing conditions, water supply, sewage disposal, water and atmospheric pollution, control and hygiene of foods and disposal of rubbish and excretes are part of the public health structure of a given area. Figure 3.8 shows the entire level of recursions together, as it can be seen subsystem one, (individual) is the core and the other three surround it.

All the factors just mentioned are the most important ones related to health status within an operative definition of health system. Figure 3.9 presents a tentative scheme of a causal model for health systems, showing graphically the causal relationships between these factors, and, in the figure, (Fig 3.8) their clustering by subsystems. Health services resosurces and Health services utilisation have been reported as it was suggested by De Miguel (1975).

The purpose of a causal model is both to represent reality and to give a scheme for predicting effects. The present causal model for the analysis of health systems does not exhaust either the complex problem of defining all the factors that produce changes in the health status of population or all their possible relationships.[36] We will choose only those factors and relationships that have a strong influence (direct or indirect) on the health status of the population in order to study them, not in an isolated way. but as interacting variables with multiple, mutual relationships. Up to a certain level most of the relationships of the causal model (Figure 3.9) are reciprocal and multiple; however, there are several

Four level of recursion clustered around each other, with individual sub system in the middle and the rest around it.

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Content has been removed for copyright reasons feedback processes in the model. To illustrate this improvement of the health status of a population can be reflected in a substantial reduction of the mortality rate (and vice versa); and if there is no change in birth rates, it may contribute to appreciable changes in economic growth per capita. The arrows indicate a supposed causal direction of influence where the effects are more clear and/or important. We have eliminated the error arrows (using "path analysis" terminology) for reasons of clarity. There are as many models of actual health system as there are countries. The present one is only a general model that can and should be varied in each study. it is also accepted that special events, such as wars, epidemics, revolution, or any other kind of "catastrophes", may radically change the health system model in a very short time.

We can state here as a general hypothesis that in the early stage of development, differences in the health status of the population are more a result of the economic development than of the health services in the area. This is partially the reason why it has been suggested that, paradoxically, at a certain stage of development all kinds of health services are of limited value in less developed countries, where attaining the goals (to improve health status, to control mortality, etc) depend on behavioural changes. Historically, the improvement of health has been explained, at least initially, by the reduction of famine (for example, recent Ethopian disaster) and the collective public health measures such as water supply, sanitation, housing, migration controls, and vaccination. Additional improvements came with the availability of personnal access to medicine, but they soon leveled off. After that, the above factors led to a next round of improvement where again public health policies, and health organisation (national health services, socialisation of medicine) became important.

This is complicated by the fact that not only does economic development influence health status, but it is itself influenced by the qualitative health status and the regional demographic structure of the population.

The causal model of health systems allows us to concentrate on the relationships between variables for our cases (six African developing countries). Sometimes changes in subsystems C and D (see figure 3.7. 3.8), such as structure or socio-cultural patterns, can have a greater impact than changes in subsystem B (health services, health planning, or health organisation), or in subsystem A.

In some sense, the health system is a "black box" of which we do not know the functioning. The most part of the present day research is directed at exploring the inside of the box. The links of socio economic and demographic factors to the health status of the population have not been systematically analysed in the literature. One of the difficulties inherent to this type of comparative research is that the relationship between health factors and other socio-economic factors change from country to country, how much weight can be attached to this statement will be discovered in the following chapters.

3.4 SUMMARY

We have given a general definition of system as a plan or scheme according to which things are connected into a whole. We have also differentiated between "closed" system and "open" system. We then identified the health system as an open system, and explained the level of recursion applicable to the health system, these levels of recursion could be from highest level "W.H.O", to lower level "Ministerial", and lower level "local government". Thus, levels of recursion represent the levels of hierarchy of systems or sub-system at which the various relevant boundaries are defined and which in totality constitute the framework for overall policy formulation and implementation.

We have also defined the type and mode of interaction in systems, as purposeful and purposive system. The main difference between these two types is: the first one displays the will in which a system selects the ends as well as the means, but for the second one, the goal is not self-determined - it has to be determined by the initiating event.

The mode of responses which a system is capable of sustaining are identified as "homeostatic", "mediative", and "proactive". The first mode guarantees the stability of the system, the second one adopts the system to the environment, the third one influences the environment or to better put it, influences the system's environment.

Thus, a purposive system can only sustain homeostatic and mediative responses, where the purposeful system can maintain all three modes.

We define here a general analytical model for health systems, which is applicable to different countries and stages of development, including the African developing countrries. In its construction, we have used cross-national and system analysis, which were already described in the previous chapter, within a sociological framework. Our model is designed to understand the relationships between health systems and social change of both health structures and society; thus we choose a dynamic (causal) model.

The concept of "health system" is central, although there is no agreement about its exact measuring. After reviewing the different notions, we formulate an operative and analytical definition in order to build up a causal model of health systems. According to this, a health system is the set of relationships among institutions, social groups, and individuals that are directed towards maintaining and improving the health status of a particular population. This definition includes both the level and distribution of health features among the population. We point out how health services alone do not determine human health; there are many other social factors that have an effect on the health status of the population. The sociological methods may help in the definition, policy-making, and measurement of health status in relation to those social factors.

A comparative study of health systems is summarised in these stages: inputs, processes and outputs. The output of the system (health status) is the main theme to this study. The model we define is fully applicable to the six African countries of our study. Nevertheless, the general model permits the comparison of the six health systems in a certain period of time. In addition, the model described, offers various possibilities for analysis, as it divides the reality into subsystems, articulating them into an open linked systems theory (as suggested by Cawdill). We present the interactions between the subsystems (individual, institutions, society, and larger systems) as well as the different factors.

We will use the described model to select the appropriate indicators for further analysis in later chapters.

3.5 FOOTNOTES TO CHAPTER THREE

1. System is not used in the way in which either an office manager or a gambler might use it, it is used as a name for CONNECTIVENESS that is, anything that consists of parts connected together will all be a system.

2. The environment is not the air we breath, or the social group we belong to, or the house we live in, no matter how much there may seem to be outside us.

3. A multi-goal-seeking system is one that is goal-seeking in each of two or more different (initial) external or internal states, and which seeks different goals in at least two different states, the goal being determined by the initial state.

4. See for example Field (1967). These orientations tend to forget a more "romantic" notion of health that was common some decades ago. For example, in 1936 Falk defined as "a precious possession, so precious that one does not ordinarily set a money value upon it. It is not exchanged in the market place. It is personal and intimate, something cherished for the pursuit of happiness" (Falk 1936).

5. This approach originated in a more sociological definition of health and disease: "illness is explicitly designated as a form of deviant behaviour, while death is viewed as conforming behaviour." From this perspective the medical care system is

seen as a social control system. (Twaddle 1974).

6. "Health System" terminology has been widely used by authors such as Anderson, Elling, Field, Weinerman, etc. A valuable attempt to apply the systems approach to health services is Hedinger (1969). Many of the references we have made here have an appropriate development in Hedinger's work.

7. The expression "Health-Services system" also has been used to define the relationships between health services and health insurance (see for example Anderson 1972b).

8. This can be considered a sociological approach to health systems analysis. Mechanic has summarised it in the following way; "The goal of any medical system is to organise for the provision and distribution of health services to those who need them, and to use the resources, knowledge, and technologies available to prevent and alleviate disease, disability, and suffering to the extent possible under prevailing conditions" (Mechanic 1968).

9. Health status in this context has usually been defined as the "D's" The objectives of the health services system of society are the reduction of premature death, disease, disability, discomfort, delinquency, and disruption - Six "D's". (White 1968).

10. An appropriate description of the system approach to any kind of organisation in Katz and Kahn (1966), chapter 2: "Organisations and the systems concepts" a system analysis model applied to

health services can be found in PAHO (Pan American Health Organisation) (1972).

11. The three stages of inputs, processes, and outputs are indispensable in a systems approach; 'without inputs the system can do no work; without outputs we cannot identify the work done by the systems". (Easton 1957).

12. This also has been developed by Blum et al. (1969) a basic summary of the system approach appears in Churchman (1968).

13. Studies about the relationships between inputs and outputs can be found in Cochrane (1972) and May (1967). Caudill (1958b) described the concept of "linked open systems" ; the physicological, emotional, small group, community, and national systems (among others) are thought of as an open systems in which what happens in one can have effects on the others. With these procedures Caudill tried to explain the effects of social and cultural factors in reactions to stress.

14. These four sections summarises theories of several authors. A system approach, like the one presented here, is made explicit by Weinerman (1971). Also, it is possible to understand the health systems from a different approach in which the units of observation are smaller: "the health services can be conceptualised as a system with points of entry and exit for the patient, the primary concern being the very personal problems of disease, disability, and death". (Anderson 1972). An example of a

systemic approach dealing with the relations between the hospital and the religious, family, and economic institutions is given in Glaser (1970).

15. Although there is general agreement among policy-makers that all people should have access to medical care regardless of income or place of residence, health planners are unable to specify what constitutes an optimal medical care system for keeping a target population healthy. (Kleczkowski, et al 1984).

16. Bryant (1969), believes that the goal is a broader one, "the challenge is to provide effective health care for all the people of each nations".

17. Odin W. Anderson specifies this principle in the following ways "the primary public question today is that of equalising access to some entry point in the health services systems regardless of family income and residence, and the collective and equitable sharing of the cost of such a service in Robin (1972). But in reference to this point, some authors have termed the pluralistic system "a non-system" speaking particularly of the United States case. For example Mechanic has stated: "This tendency to go in every direction at once to avoid any unitary national policy has led many persons to refer to American medical care as a "non-system". This designation is a poor one because it fails to take into account the extent to which the current organisation of medicine consciously reflects social and ideological priorities held by large numbers of decision-makers in health cares" (Mechanic

1974). Navarro (1973) has added that the "non-system" is due to problems of organisation and not to problems of financing.

18. See, for example, the discussion in Backett (1969), and in Blum et al. (1969).

19. Anderson and Kravits (1968) still consider that alternatives are value-free judgments, although priorities are not: "The systems approach is objective in that it tries to determine what it is possible to achieve with certain resources, organisational arrangements, professional predilection and public expectations. The systems approach can posit a range of alternatives again with reasonable possibility of achievement, and suggest the net result as to professional and patient satisfaction, organisational arrangements, possibilities for innovations, and overall cost (Anderson and Kravits 1968).

20. Our purposes are to introduce an alternative to his model, incorporating the systems approach, within a cross-national research framework. Elling's article appears in Cross-National Study of Health Systems, Political Economies and Health Care. (1980). A definition of the sociological task in this kind of research can be found also in Glaser (1970).

21. This concern for general health in no way discounts the need to identify discrete, empirically discernible dimensions. The managerial school of thought often emphasises operational measures of the health services themselves and is content with

such measures to get at efficiency quite apart from measures of the health of the people.

22. For a sense of desperate life conditions and their effect on health orientations, see S.D. Messing (1973); especially his use of the term "discounting health".

23. This has been suggested by Weinerman (1971).

24. Some authors have differentiated between a public health system (or environmental health services) and a medical care system (or personal health); see for example Bice and White (1971). Anderson, Smedby, and Anderson (1970) have defined the national health care systems as composed of two dimensions: Organisation of health services and resources of health services. These differences are more or less real, but De Miguel (1975) has tried to develop a more elaborated model.

25. An operative definition of health status measuring the function levels and their social values is developed in Patrick, Bush, and Chan (1973). For them, health status is "the product (expected value) of the social preferences assigned to levels of function and the probabilities of transition among the levels over the life expectancy of an individual or a group". They construct a comprehensive set of 29 function levels to be combined with a series of sympton (problem complexes).

26. A development of these ideas can be found in Somers and Somers

(1961).

27. Selye (1956), Grinker and Spiegel (1945), Caudill (1958b), Dohrenwend and Dohrenwend (1969), Janis (1958), Levine and Scotch (1970), and Langner and Michael (1963).

28. For example: "Low death rates are compatible with quite different levels of medical care provision and utilisation". (Peterson et al 1967).

29. Planning is in essence "an organised, conscious and continual attempt to select the best available alternatives to achieve specific goals" (Waterston 1965).

30. Elling (1974) has specified it as: "the extent to which planning in this sphere (planning for health) takes into account plans in other sectors and the extent to which general economic and social planning takes into account planning for health".

31. For example, a Markovian model for planning personal health services is presented by Navarro (1969).

32. Mechanic has summarised these hypotheses as follows: "the poor are less likely to receive adequate treatment, are more likely to come into treatment during more advanced stages of their illness, and are more likely to experience persistent morbidity and disability" (Mechanic 1972). In a more polemic way, Sigerist noted that: "the propertied class, moreover, knows very well that

a diseased working class is a menace to its own health. Tuberculosis today is largely confined to low income groups, but veneral diseases have not yet learned to respect class barriers" (Sigerist 1938).

33. The influence of community leaders in the decision-making processes of the health systems is described in Elling and Lee (1972).

34. For example: "health is a factor in the development process, being both an instrument for and a product of development" (Bryant 1969).

35. Some doctors have called attention to the fact that medicine is sometimes responsible for the suffering of many patients that in other worse conditions would have died. Or Myrdal believes that, "It is conceivable that a large part of a population may be diseased, or at least lacking in normal vigor, all or most of the time even though rates of mortality are decreasing and life expectancy is increasing. It is even conceivable that people live longer only to suffer debilitating conditions of ill health to a greater extent than before" (cited in Myrdal 1968 p.1554). From an economic point of view, this is a problem that modern societies will need to face soon.

36. An open system maintains "a continuous inflow and outflow of energy through permeable boundries". (Katz and Kahn 1966).

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CHAPTER FOUR : DATA SELECTION

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DATA SELECTION

4.1 INTRODUCTION:

In this chapter we attempt to select those variables which will be involved in our analysis. Variables[1] from the four subsystem mentioned in chapter three will be reviewed and the most suitable ones to serve our purposes will be chosen.

4.2 SELECTION OF DATA

If one is interested in comparing levels of health in different countries or under different systems of organising health services with a view to suggesting ways in which the level of health in a particular country might be improved, there are certain fundamental questions that one must attempt to answer. Foremost is the question: "What is better health?" Indeed, what is "health?" Moreover, even if measures could be found comparing health in different countries, how much credit can be given to the system of organising health systems for the level of health actually attained in a particular country? In other words, is the system of organising health services the principle factors which determines the level of health? What are the other factors which influence the level of health? We have indeed, clarified that the different systems of organising health services are moving towards one goal "the betterness of health status of the nation concerned".

Finally, given a knowledge of the number of physicians, the number of nurses and hospital beds, the level of national prosperity and the level of health in several African countries, is it possible to appraise the efficiency of different health systems? These are some of the questions on which we hope to shed light in this study.

Having in mind De Miguel's idea. (De Miguel, 1975) and also the classification of factors affecting the health systems, (see chapter three) the next step is to establish the framework for the study, we have already mentioned that our first aim is to compare level of health in different developing countries, and then examine the role of those socio-economic factors which can explain and also affect this level. Therefore, our first task is to select those factors (indicators) which from our point of view determine the level of health, in African developing countries. To do so, we have decided to follow the World Health Organisation guidelines in setting up our factors.

In the World Health Organisation issue of "Development of indicators for monitoring progress towards health for all by the year 2000" (W.H.O., 1981a) a clear description of indicators (factors) which can be used to measure any changes in healthiness of nations is given, it is useful to quote some of its definitions.

> ....If "health for all" was one single, easily quantifiable entity for all people, the question of selecting relevant indictors would scarcely arise. But since by very nature it means many different things to different people, it is necessary to identify those indicators that could illustrate to the people concerned....
>
> Development of indicators for
> monitoring progress towards health
> for all by the year 2000 (W.H.O. 1981a).

.... as the name suggests, indicators are an indication of a given situation, or a reflection of that situation. In W.H.O.'s guidelines for health programme evaluation (W.H.0, 1981b) they are defined as "variables which help to measure changes". Often they are used particularly when these changes cannot be measured directly. They have been given scientific respectability....

Again it is useful to quote the definition for this scientific respectability of the indicators.

... The ideal indicators should be valid - that is, they should actually measure what they are supposed to measure; they should be objective ; the answer should be the same if measured by different people in similar circumstances; they should be sensitive - that is, they should be sensitive to changes in the situation; and they should be specific - that is they should reflect changes only in the situation concerned. In real life there are very few indicators that comply with all these criteria. The scientific respectability therefore has to be tempered with a certain humility. As stated above, indicators are merely reflections of a "real thing". They are indirect or partial measures of a complex situation, but if measured sequentially over time they can indicate direction and speed of changes and serve to compare different areas or groups of people at the same moment in time...

These indicators may be used within country to fulfill, their objective, this is illustrated as follows:

... The main emphasis, is on indicators for use at all national levels. Countries may use national averages sequentially over time to assess progress in attaining the objective of their own strategies for health. The focus on the national level, however, does not mean that only country averages are important. On the contrary, indicators are needed to illustrate the differences in health situation within if they are to be meaningful in showing progress and for identifying operational strategies.

The possibility of using these set of indicators at an international level is again given clearly by these guidelines.

> Indicators can also provide yardsticks whereby countries can compare their own progress with that of other countries, especially countries at similar levels of socio-economic development. International comparisons can be helpful in determining to what extent a region as a whole or a group of countries is making progress ...

Hundreds of possible health and health-related indicators exist, and to choose the best suitable one for our study, we had this in mind that our study has been carried out for developing countries and it was not wise to choose the most sophisticated factors, and then found out that there would not be data available to form the indicator, therefore, our task was to choose those factors which could be used effectively and purposefully. The followings explain the way in which these factors (indicators) have been chosen.

4.2.1 Selection of Factors Affecting Health System

As previously mentioned, we have considered the health system as an open system with many outputs, which health status of those group of people related to the system is one of these outputs, (the interesting thing about this open system is that this particular output "health status" can be considered as input for the system.)

The question is "how do we measure the health status of people?" Therefore our immediate step is to specify the indicator which measures the level of health.

4.2.2 Measurement of Level of Health

We have already given several definitions for "health". The very breadth of these definitions implies that "health" is an unattainable state of being, if not for individuals, certainly for nations. Indeed, "health" as defined could only exist in Utopia. It is almost impossible, therefore, for us to translate these definitions into a set of criteria by which the health of different countries could be compared.

"Health" is also a word that includes two different meanings: personal well being, a condition of the body or mind and a collective organisation for health services utilisation. The extent of which the population make use of medical services is not an indicator of health status nor of ill-health. In some societies health would tend to be measured as an individual characteristic, while in other cultures it is considered as a collective or group feature. For the same reason indicators of health should always be put in relation to the age and sex structure of the population. There are many indices of health status: Mortality rates, pollution, delinquency, suicide, incidence of communicable diseases, poverty, life expectancy, radio activity, morbidity and so on. What makes the comparative and trend analysis difficult is that very sensitive indices are only valid for a short period of time.

Health indicators involve three aspects of health: physical, mental and social well-being. The problem with the indicators of well-being in health status is that they are rooted on an idealogical basis. "Well being" is radically different within an individualistic conception of a capitalist country than for a collective approach. "The inability to perform in a social role as worker or student, or as spouse or parent, as a consequence of illness or disease is a socio-medical measure of the level of health". (Elinson, 1973). If we accept this definition, we need to admit that the notion of the level of health is an ideological concept; a reality which would make the WHO's leaders rather unhappy. (For example, the United State's scale of health status tend to include items which are difficult to apply to non-capitalistic societies, or simply to other countries such as hobbies, gardenwork, love life, expenditure patterns, recreation). An additional problem in global health indicators is that they tend to disguise the inequalities of redistribution and to identify progress with the reduction of general mortality, even if some sectors of the population do not receive appropriate care. Physical well being includes not only global indicators such as the lack of morbidity, but a certain nutritional status, which is an individual indicators. Other types of health indicators are of public health, namely: the percent age of the population (or dwellings) with water supply, proper sewage facilities, electricity, central heating, etc.

Some assistance in choosing measures of health can be gained from the report of committee of Experts on the International Definition and Measurement of Standard and Level of Living (U.N. 1961). In this report, three indictors are suggested, namely, crude annual death rate (mortality rate), expectation of life at birth, and the infant mortality rate.

4.2.2.1 Mortality and Morbidity Rate:

Due to the development of health services and the distribution of health services among the population, mortality has begun to decrease to the point that morbidity follows a trend of becoming a better indicator of health. For sociological purposes, morbidity indicators are more accurate than mortality rates but there are less data about morbidity and they are of poorer quality.

Morbidity is a feature that generally admits different degrees, mortality does not: a person is either dead or alive. The World Health Organisation considers that: "Mortality statistics, because of their inambiguity, remain where they are available, the most practical index of variations in the level of health of populations and provide a basis for hypotheses concerning the determinants of variation which may be tested by appropriate means. Their informativeness depends, first, upon their completeness and secondly, on their analysis". (WHO "Programmes of Analysis of Mortality Trends and Levels" Geneva Who 1970). However, for the first time, mortality and morbidity are not related; a person usually dies of a disease which is only a partial contributor to his illness, as usually one suffers from other diseases at the same time, or has suffered from many other diseases before. In a country, morbidity may be high or low, independently from a high or low mortality rate. Then, we may have a typology as the following: (see table 4.1)

Case A represents the lowest health level of a community; Case B is an intermediate one, typical of countries beginning to develop; Case C is more common among post-industrial societies, and finally, Case D is a general ideal which the most advanced countries are trying to achieve. The relationship between morbidity and mortality changes depending on the illness and also on the stages of economic development. A general

Table 4.1

TYPOLOGY OF HEALTH

	high morbidity	low morbidity
high mortality	A	B
low mortality	C	D

Source: See text

relationship is blurred by these two differences.

One of the problems of morbidity statistics is that they entail a subjective component. On the other hand, some causes of death are not easily included in morbidity categories, such as: suicide, homicide, or violent mortality in general. Some morbidity indicators are also measures of the utilisation (and availability) of health services. It is important to differentiate between general morbidity, hospital morbidity, and morbidity of notifiable diseases. For this purpose, most morbidity surveys were designed, taking into account data from physicians' file, hospital, physical or mental examinations, the patient himself, his relation and so on. In morbidity we must always distinguish between incidence and prevalence. Incidence is important to assess future needs and to measure the improvement made in the erradication of our illness. Prevalence measures the present needs for health services and the use of health resources in the community.

Morbidity statistics are generally unreliable except in the case of the statistics of notified comunicalbe diseass, and even in these cases the validity is very low.

The state of health is being treated implicitly as a neutral state. Deviation from this neutral state is asumed to occur in only one direction, namely, ill-health. Ill-health may then be said to represent "the failure by the body and mind to adopt themselves to the environment, a failure which is the resultant of two factors, the imperfection of human nature and the hostility of the environment. (Roberts, 1952). In concentrating on the measure of ill-health, we shall be assuming also that the level of health can be measured satisfactorily, if imperfectly, by the level of ill-health.

S.J. Mushkin notes that "the most frequently used indices of health status, however, are negative ..." (Mushkin 1962). Accordingly mortality rate, will be used to indicate a nation's state of health.

4.2.2.2 Life Expectancy Tables: (Life Expectation at Birth)

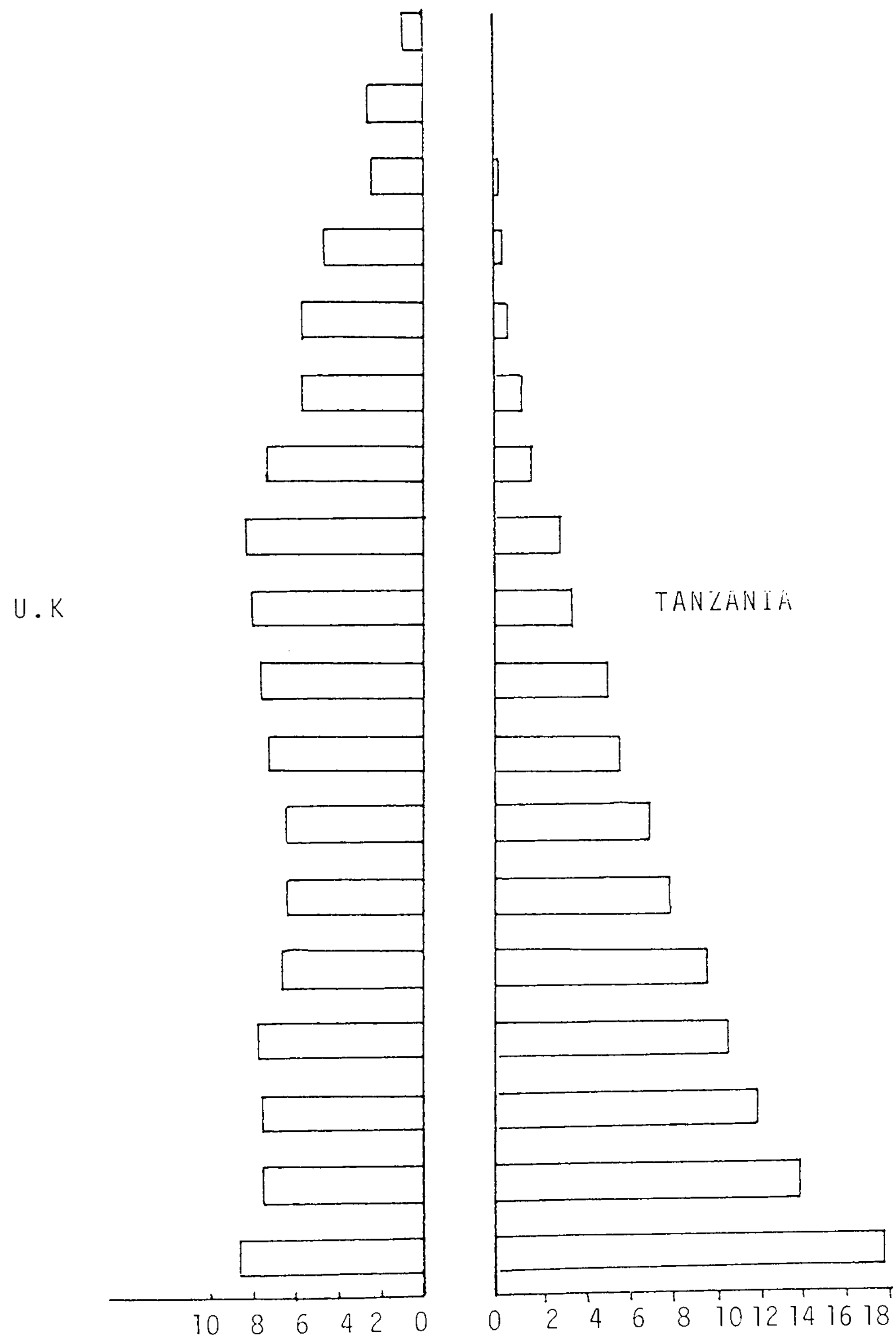
The life expectancy tables are used by some researchers in different studies (for example, R. Faruquee, 1979). The use of these tables depends on the availability of relevant data and they were mainly established for developed countries. But since the improvements in life expectancy have become slight, or even non-existent, these tables nowadays ceased to be used for developed countries. The life expectancy improvements for developing countries still show significant variation, and could be, unlike in developed countries, a right indicator to measure these changes in level of health of these nations.

4.2.2.3 Infant Mortality Rate:

This indicator refers only to a small segment of the population and, therefore, in itself, is not entirely a satisfactory measure of the level of ill-health in a country as a whole. On the other hand, mortality rate refers to the entire population. However, because the latter rate is so dependent on the age structure of the population, we have, therefore decided not to include this indicator in our analysis. Figure 4.1 clearly shows the difference in the age structure of population of the United Kingdom and Republic of Tanzania

Figure 4.1

Population Age Structure - United Kingdom and Tanzania 1965



Source: Maurice King, Medical Care in Developing Countries (Nairobi: Oxford University Press, 1966) total population 1965.

Having decided how the level of health might be indicated, we next face the problem of deciding which of the principle factors that influence levels of health should be included in our analysis.

There are, of course, many factors which affect the level of health. The close relationship between poverty and disease is commonly recognised (C.E.A. Winslow, 1951, - M.A. Pond, 1961). Similarly, the existance of a definite relationship between health and the supply of health services in highly probable. In addition, other factors, such as climate, rate of population growth, size and density of population, level of education, etc., probably have an important influence on health. We therefore will go through some of these to select the most suitable indicators.

4.2.3 Culture

In the introduction to his study of Spanish speaking people of the American South West, Lyle Saunders outlines "a few simple but highly important generalisations about medicine and culture and the interrelations between them". (Lyle Saunders, 1954)

> The first point is that the practice of medicine is a social activity. In whatever form it may take and whenever it may occur, the practice of medicine always involves interactions between two or more socially conditioned human beings. Furthermore, it takes place within a social system that defies the roles of the participants, specifies the kinds of behaviour appropriate to each of those roles, and provides sets of values in terms of which the participants are motivated. The way anyone behaves on either side of the therapeutic relationship is in part a function of his understanding of

his social role in that situation and of the kind of behaviour that is proper for it.

The second point to be emphasised is that medicine is a part of culture. In its totality, medicine consists of a vast complex of knowledge, beliefs, techniques, roles, norms, values, ideologies, attitudes, customs, rituals, and symbols, that interlock to form a mutu ally reinforcing and supporting system. Such a system is designated by the term "institution". Medicine as an institution is integrated with other institutional complexes - government, religion, the family, art, education, the economy - into a functioning whole, which is culture. Each culture has had its own unique system of elements constituting the institution of medicine.

(Lyle Saunders, Cultural Difference and Medical Care). (New York: Russell Sage Foundation, 1954), pp.5-8

Saunders then proceeds to illustrate these points in the case of an English speaking medical profession providing medical care to a Spanish speaking community. The problem arising from the interaction of these two different social systems and cultures in the medical situation are set forth clearly by Saunders.

His beliefs are bound to be right. Medical care is a part of a culture, what Saunders has not mentioned is the policy maker's headache to choose between Traditional and Western medicine in developing countries.

There has been a bitter discussion on how one should mix these two different doctrines together and which one should have more support. There are writers who believe that the Western medicine is a strong tool in the hands of colonists.

Gish (1977) portrays these instruments as "coming along with" colonial rule through his references to missionaries opening things up and medical services under military charge suggest a more active role:

> The conquest of Asia, Africa, and the Americas by Europe, and the consequent assumption of state power by Europeans, led to virtually world-wide domination of European forms of organization and scientific systems.[2] Western medicine, like virtually all other things European, received official support while traditional systems either received none or were consciously suppressed....
>
> The colonial powers began early to introduce their own medical care systems into overseas territories.[3] In many cases, these early services were developed by, and were in the charge of military personnel. Typically the pattern of "modern" medical care during the colonial era had three major components; the urban hospitals; the rural dispensary - often Christian church related; and the hygiene or public health element. In essence this remains the pattern of the Third World right up to the present.
>
> Gish, O. The political economy of primary care and "health by the people": an historical exploration, 1977.

Onoge sees a more active role played by modern medical care and public health in the establishment in Africa (Onoge, 1973). Brown details the early activities of the Rockefeller Foundation in public health to make things safe for U.S.A. - capitalist expansion. (Brown 1976).

On the other hand, the scientific (modern) medicine has strong support among government of developing nations. This is due to the existence of inadequate, insufficient, improper, and unhealthy sorts of traditional medicine. Therefore, one can have serious grounds for doubting the efficacy of much of it. An interesting example of pure charlatanism comes from the Yoruba in Nigeria where medicine men meditated between the God of smallpox (literally a speical God for this disease) and the people. When a smallpox victim dies, these medicine men generally received all the worthy possessions of the deceased. When the WHO sponsored eradication programme began to take hold, some of these medicine men were found gathering scabs from victims to use in keeping the disease going (Foster 1977). But we cannot ignore the efficacy of some of the traditional medicine like; quinine for malaria, which has been derived from traditional practices. There are also generally healthy ways of life as a cultural theme of some traditional systems. Ayurvedic medicine, Traditional Chinese medicine and Persian medicine might all make this claim. (Leslie C. 1976).

Another important issue is the question of trust, we have people believing in scientific medicine (western type of medicine) and people who trust and confide the traditional way of medicine. We have not measured the power of trust in anyone of them but have instances which greatly emphasise this sort of trust. Cases have been reported that, for example, of Australian aborigines who have been "boned" (declared certain to die) and by all signs on a certain course of death being "brought back to life" when the medicine men declares it a mistake or says a counter spell has worked. (J. Powels 1973).

What Elling suggests is: Whatever the mixture of Traditional and Western medicine is that may not matter as much for health as the control and distribution of resources in society. (Elling 1981).

We have so far established the existence of two different sets of medical services (if we can call traditional medicine a service).

If we believe that Western medicine is something that has been imported to Third World countries (we do not question the reason for this importation, whatever the reason was, it has been established scientifically and has been used by the different sector of nations), we must accept that traditional medicine is part of a culture, it has existed for centuries, it may have changed a little in its nature but still exists. This existence of traditional medicine does not belong to one country. Each country has its own culture, and traditional medicine. We cannot measure the effect of culture, we may be able to measure the influence of traditional medicine in different societies but that is another research and is out of the context of this study. What we can do is to minimise the effect of culture by choosing our cases from those nations with more or less similar culture. This means if one nation has traditional healers, the other one has something similar if not exactly the same. On the other hand, as Weinerman has put it "The cultural factors are becoming less important than the level of economic development". (Weinerman 1971).

However, going back to the stage of selecting factors (indicators) H.E. Sigerist, in his book (Civilisation and Disease, 1960) gives a more general discussion of the diverse factors which affect health. Among the several influences on health outlined by Sigerist are religion, philosophy, law, science, literature, art, and music. The principle cause of disease, however, is thought by Sigerist to be poverty; and the obvious remedy, then is to raise the standard of living.

Ignorance and low levels of education are listed by Sigerist as a second major cause of disease. The effectiveness of medical services is set forth as the third major factors affecting the level of health. Not only must medical practice keep face with the advances of medical research, but the system of health services must be such that it "reaches everybody, healthy and sick, rich and poor..." (Sigerist, 1962, Hobson, 1961 - W.H.O. - 1981a).

We have already discussed the effect of culture on health. By culture, we mean what Sigerisit has put in form of religion, philosophy, law, science literature, art and music, now it is important to discuss the remaining factors, we therefore go through each of them and select our factors for final analysis.

4.2.4 Poverty and Affluence

As it was mentioned earlier (Sigerist, 1962), there exists a strong relationship between poverty and health. There have been a vast number of studies in this subject and it is useful to give examples of such studies. Warren Winkalstein has proved that there is a remarkable correlation between the incidence of tuberclosis and poverty among white males in various age groups. There is also significant correlation between poverty and cancer of the stomach in white men and women. (W. Winkalstein, 1972).

Significant correlation between low family income and high post-natal mortality, and low birth weight, have almost never failed to be verified, and infant survival bears remarkable relationships to socio-economic variables even after effects of medical care have been controlled. (John Chapman and Anne Coulson, 1972 - H.C. Chase (ed)., 1974 - R. Lewis, M. Charles and K.M. Patwary, 1963).

However, income and infant mortality are complexly related and when mortality is high the relationship is in great part apparently dependent on patterns of living associated with relative deprivation, poor education, and cultural patterns. (D. Mechanic, 1968).

The most impressive relationships of well-being to economic factors are shown by infant death rates in the United States which respond to level of economic adversity as measured by unemployment (M.H. Brenner, 1973a). The same correlation between economic instability and infant mortality has been observed for England and Sweden.

Increase in first admission to mental hospitals are evident during economic down turns and declines during increased prosperity There is also a consistent inverse relationship between economic fluctuations and deaths from heart disease and chronic nephictis. (M.H. Brenner, 1973b,c).

In general, empirical evidence indicates that economic status is directly related to well-being, particularly where poor people are directly compared with better-off people. (E.M. Kitagawa, 1969 - E.M. Kitagawa and P.M. Hauser, 1973).

However, when the U.S. is viewed as a relatively affluent composite of 50 states, the more affluent states are also associated with increasing mortality. (R. Auster, I. Leveson and D. Sarachek, 1969). This deleterious effect of affluence has been attributed to various factors such as overly indulgent dietary, infrequent exercise and dangerous recreational and driving patterns.

Poor nutrition (generally, but not always as consequences of poverty) has been specifically identified as a critical factor in the predisposition to and outcome of infections. (M. Behar, 1974 - J.M. Bengua, 1974 - N.S. Scrimshaw, 1959 - N.S. Scrimshaw, 1968). Nutrition has also been repeatedly suggested as a critical factor in the development of the brain tissues in infant. (N.S. Scrimshaw and J.F. Gordon (ed), 1968 - J. Tizard, 1974 - W.H.O., 1974).

In Britain, some experiences indicate that limited incomes and increased rents for better housing meant a poorer diet and subsequently more illness, even if in better surroundings. (S.V. Kasl, 1972 - J. Kosa, A. Antonovsky, and I.K. Zola, 1969).

Having established a firm relationship between poverty and health, the next step is how to measure poverty or affluence.

There is very little specific theory on the socio-economic determinants of mortality, as opposed to biological theories about causes of death.

The lack of theory relating to the socio-economic determinants of mortality manifest itself in the literature by a lack of agreement on what variables should be included in the analysis.

On the other hand, there has been a great deal of discussion in the past decade by certain economists and certain international organisations as to which measure of national prosperity is most meaningful for making inter-year and inter-country comparisons.

Gross National Product, Gross National Expenditure, Gross Domestic Product, Gross Domestic Expenditure, Net National Product, and Net National Income are but a few of the various concepts suggested for measuring the level of national prosperity.

In the study of the International Social Security Associtiion, "Volume and Cost of Sickness Benefits in kind and Cash", (International Social Security Association, 1963) Net National product at factor cost was chosen as the standard of measurement for international comparisons. The reason for this choice is given as follows:

> This "yardstick" has been chosen because the Net National product at factor cost per head is given in the statistical publication of the United Nations and that at least for some countries - the national account, inparticular the calculation for the two principle magnitudes, the Gross National product at market prices the Net National product at factor cost ... have been standardised to a large extent...
>
> International Social Security Association, volume and cost of sickness benefits in kind and cash, part I: General

Report, Part II: International Analysis (report submitted to the XIV General Meeting of the ISSA) (Geneva: as appears in the Bulletin of the I.S.A., Vol.16, Nos.3-4 (March-April, 1963), P.11).

In another study, by the International Labour Office entitled The Cost of Medical Care (I.L.O., 1959), use has been made of these different magnitudes:

1. the average annual income per head of the population of the country (referred to as the income per head);
2. an annual reference wage; and
3. the national income per economically active person.

In this study national income referred to national income at factor cost as presented in the United Nations Statistics Bulletin, and the annual reference wage was "as a rule, the annual wage of an unskilled labourer in the manufacture of machinery other than electrical machinery" (I.L.O., 1959). The first two indicators, average annual income per head and the annual reference wage, were used as yardsticks against which changes in expenditure and cost in a particular country could be observed, while the third indicator, national income per economically active person, was used for purposes of international comparisons.

Rashid Foruquee in his study entitled "Sources of fertility decline" (R. Forquee, 1979) has used Gross National Product per capital and Gross Domestic investment as a percentage of G.D.P. and average real growth rate of G.O.P. to represent the dynamics of socio-economic growth.

Fraser, also has taken real gross domestic product (GDP) per capita, as one of the socio-economic factors believing to determine the level of health (Fraser 1973). He then proved that in the developed world the general standard of living (indicated by GDP per capita) plays a major role in determining the health status of a population.

In yet another international inquiry, that of the World Health Organisation, (B. Abel-Smith, 1963) expenditure on Gross National Product, was chosen as the appropriate yardstick against which changes in health expenditure could be measured.

4.2.5 Gross Domestic Product Per Capita

Gross Domestic Product Per Capita (G.D.P per capita) is the most widely discussed socio-economic determinant of mortality, primarily because it is considered a summary of the ability of a nation to contribute to its economy. Therefore, the indicator (factor) which indicates the wealthiness of a nation and will be used by us in this study is Gross Domestic Product Per Capita.

In using G.D.P. per capita, we have tried to measure the value of output of goods and services produced each year by the residents of country. It is called G.D.P. because no deduction has been made to allow for fixed capital assets consumed in the production of the output. We have tried to collect all G.D.P. in "factor cost", this means that output has been valued before adding indirect taxes and subtracting subsidies. The alternative basis of valuation is at "market prices", which is equivalent to domestic product at factor cost plus indirect taxes less subsidies.

TABLE4.2

Components of Expenditure on Gross Domestic Product

1. Private Consumption Expenditures
2. General Government Consumption Expenditures
3. Gross Fixed Capital Formation of Private Enterprises
4. Gross Fixed Capital Formation of Public Corporations
5. Gross Fixed Capital Formation of Government Enterprises
6. Gross Fixed Capital Formation of General Government Prices
7. Increase in Stocks
8. Expenditures on Consumption and Gross Capital Formation
   Export of Goods and Services
9. Expenditures and Gross Domestic Product and Imports
   Less: Imports of Goods and Services

All data on G.D.P. have been converted to US Dollars, and the rate of exchange used, can be found in Appendix A-5.

The next group of indicators are those presenting the level of education in a country. The following explains these indicators:

4.2.6 Education

Samuel Preston and Robert Gardner have stated that:

"given motivation, the level of mortality in a population must be a product of two factors: the level of knowledge regarding ways to combat diseases, and the means available for implementing that knowledge. These factors operate at both the individual and the societal level". (Preston, S.H. and R. Gardner, 1976).

> "Factors Influencing Mortality levels in Africa: International Comparisons and a Japnese Case Study" presented at the seventh summer seminar in population, June 14-18, 1976, EAST-WEST Population Institute, Hondula, Hawaii.

Significant relationships have been shown for income and education to mortality generally, with education being the better predictor. Because education and economic status so closely parallel one another, as well as correlating with housing, employment, access to opportunities, and so on, the effects of these variables are difficult to separate. (E.M. Kitagawa, 1969 - E.M. Kitagawa and P.M. Hauser, 1973 - M.H. Nagi and E.H. Stockwell, 1973).

By and large the level of education is a little difficult to measure in developing countries. Faruqee (1979) considered daily circulation of newspapers as appropriate indicators, in World Health Organisation issue of indicators for monitoring progress towards "health for all by the year 2000", they have considered adult literacy rate as the contributor of education to health. (WHO 1981a).

In a study carried out by Fraser, the percentage of persons in the age group 15-24 participating in programmes of higher education was shown as the appropriate indicator to measure the level of education in the developed world. This indicator proved to be insignificant to determine the health status of those countries involved in his study. (Fraser 1973).

In the present study, we have used the percentage of primary students as a more or less adequate indicator for measuring the level of education.

Figure 4.2 shows the number of student (third level) per 100,000 of population in different part of the world.

4.2.7 Indicators to Measure the Supply of Health Services.

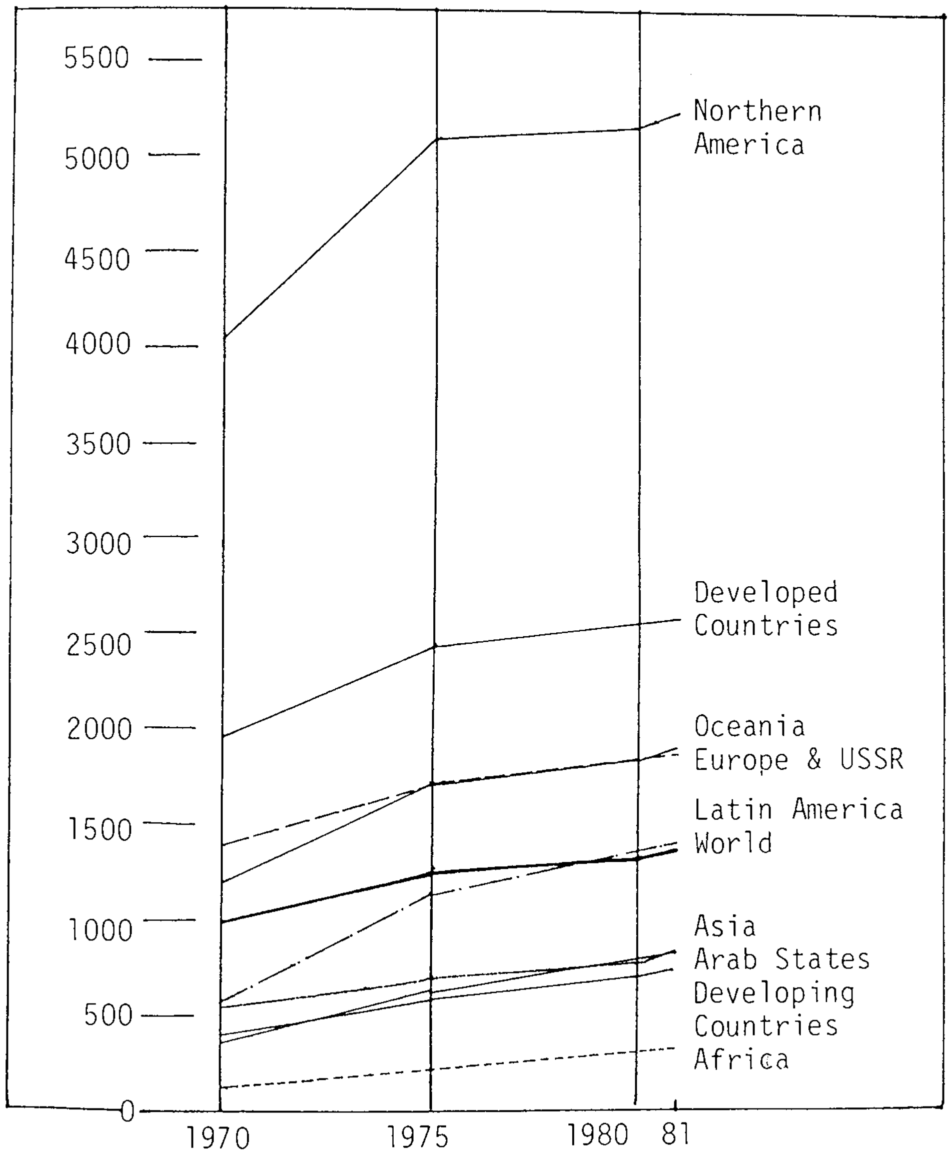
In order to indicate the supply of health services, we shall focus our attention on the supply of health care facilities and medical manpower. Health care facilities are to be indicated by the total number of hospital beds per 1000 persons, medical manpower by the total number of licensed physicians per 10,000 persons, and number of nurses for 1,000 people.

Fraser in his study entitled "An international study of health and general systems of financing health care", (Fraser 1973) has chosen the same above mentioned indicators to indicate the availability of health care resources. As for the variables describing availability of health care resources, the number of physicians per 10,000 of people was to be negatively related to infant mortality rate (infant mortality was taken as the indicator measuring the healthiness of the nation involved in his study).

The number of nurses and midwives was shown to have an important influence on levels of infant mortality. As for the number of

Figure 4.2

Number of students at the third level per 100,000 inhabitants



Source: UNESCO, 1983

hospital beds per 1,000 persons, this was shown to be a significant factor in determining the national level of infant mortality.

We are aware that the health service facilities may or may not be in full employment, or utilised to the same extent from one year to the next or from one country to another. Moreover, "the effectiveness of these services depends to a considerable extent on the way in which they are organised, on their distribution and on the quantification of the medical personnel." (United Nations, International definitions...) (U.N., 1961).

The quantity and quality of the auxilliary medical facilities and personnel with which hospital beds and physicians are combined also determines the overall effectiveness of the latter. Clearly, the hospital beds in a small nursing home which is under-staffed and poorly equipped will be less effective than the bed in a modern university or teaching hospital. Similarly, the physician who practices alone in a house surgery without ancilliary staff and with little medical equipment will probably be far less effective than the physician who works as one a team in a modern clinic which is fully equipped with auxilliary medical facilities and personnel. The number of hospital beds, the number of physicians and the number of nurses, therefore, are only crude indicators of the supply of health services. However, in the absence of comparable statistics on utilisation, and effectiveness of the organisation, and the quantity and quality of auxillary services we use data on the number of hospital beds, number of physicians and the number of nurses to indicate roughly the supply of health services. Notice must be taken that, in using the number of nurses we used both registered and qualified nurses in our calculations.

Ideally, we would also like to include in our study, a measure of the supply of health goods and services in real money terms. Expenditures on health have been defined as all expenditures on health services. Abel Smith (B. Abel-Smith, 1963) has a clear definition for health services as follows:

> In addition to services that lie clearly within the health field, the following are also included: services given to facilitate physiological processes such as pregnancy and delivery and to safeguard the health of mother and child; such preventive measures as vaccination and immunisation, periodic medical examinations of school children, and medical screening of apparently healthy individuals for the detection of pathologic lesions such as tuberculosis, cancer and the like; such promotive measures as nutritional services to vulnerable groups such as pregnant mothers, infants, pre-school children and school children; measures for health education other than that provided in general education; the case of the eyes, ears and teeth not only by specialist treatment but also by the provision of hearing aids, dentures, spectacles and other appliances; plastic surgery that is medically prescribed; and the transport costs of sick or injured persons by ambulance services and or persons accompanying the patient when the accompanyment was ordered by a physician and was indirectly paid for. All these health services for the whole population, military (including veterans), as well as civilian, in institutions (including prisons) as well as at home, are within the scope of this study.
>
> B. Abel Smith "Paying for health services in six different countries", Public Health Report No.17 (Geneva: World Health Organisation; 1963) p.25.

Because of the lack of data, we are at liberty to assume that the expenditures on health will at least cover a large number of what Abel

Smith believes as health services.

However, as with most definitions there is "no-man's land" wherein the exclusion or inclusion of a particular item is arbitrary. For example, with respect to purchase of certain citrus fruits, it would be very difficult to determine the point at which a grapefruit was being bought for its medicinal qualities for the prevention and cure of a cold rather than for its more general food value.[4]

The main problem, however, is lack of data which describe even the larger, more commonly accepted aspects of health services. Because of the absence of comparable data which conform to this definition or to a commonly accepted interpretation of these definitions, measure of supply of health services in real money terms will only be included in its crude form i.e. health expenditure as its crude form and we do not try to classify them according to Abel Smith definitions.

For the purpose of comparison between Government expenditures, we have chosen to include expenditure on education and agriculture. Again these expenditures are used in their crude forms.

Included in our analysis are observations from the experience of six different countries, they are, Republic of Botswana, Republic of Kenya, Mauritius (excluding Island of Rodriguez), Federal Republic of Nigeria, Kingdom of Swaziland, and United Republic of Tanzania (excluding Zanzibar).

The reasons for restricting this study to the above mentioned countries are:

- We did not want to include any Arab African countries in our studies, because of the vast cultural differences;
- Differences in culture are probably not as great as they might be; and thus, the influence of different culture on comparative levels of health is not as great
- We tried to keep to those countries where governmental publications are in English;
- The very concepts of physicians, nurses, hospital beds are more comparable in these countries, and finally;
- These countries are cash economies, and the meaning of G.D.P. is also more comparable;

The statistical analysis of the present study is centred on the period between 1961-1980.

Data are collected for this period, sources of data can be found in Appendix A-4 when collecting data for the sake of comparison, a questionnaire was designed and sent to the Ministries of Health of the countries involved in research. The questionnaire can be seen in Appendix A-2.

The US dollar was used to convert different currencies. The rate of exchange together with the national currency of the countries involved in the study can be seen in Appendix A-5.

4.3 SOURCES OF DATA

To collect data there are several kinds of sources to consult, with many publications within certain of the types of sources. The type with the most numerous publications - at least one each year for nearly every country - is the National Statistical Report. Usually there are reports on vital statistics, population, and socioeconomic development information. Sometimes these reports are issued by a Central Statistics Bureau and sometimes by the ministries concerned: planning, economics, industry, agriculture, health, education, etc. (Variously named and organised in the different countries). Most ministries of health (or their counterparts) issue annual reports on mortality, morbidity, and health personnel and facilities and their use and cost.

A second type of source is multinational, most usually reports issued through the U.N. system. The major source is the Demographic Year Book giving population and vital statistics, including birth rates, general mortality, and infant mortality.

Of special importance here are several WHO publications: The World Health Statistics Annual gives mortality and morbidity information in one volume and health services personnel and facilities information in another volume.

Beyond the major types of secondary information sources there are many special studies. One collection of some 20 volumes directed toward the health systems in some underdeveloped countries has been prepared for the AID (Agency of International Development) by the Office of International Health, USPHS - the Syncrisis series. While this series constitutes a major resource on the health systems of particular countries, it is uniformative and uncritical.

4.3.1 Some Technical Problems with Secondary Data

Possibly the most general problem is one of context and meaning of statistical items reported apart from their content. For example, Bryant asks,

> ... What is a bed? It may be a rope stretched between the sides of a wooden frame, or it may be canvas with no sheets or blankets. It may have a mattress and sheets but may be attended only by auxiliary personnel; or doctors and nurses may be there, but a lack of equipment and materials may seriously limit the quality of service. These differences are seen between countries and within a country, and they may be the differences between the last century and this century in terms of medical care.
>
> John Bryant, Health and the Developing World (Ithaca, N.Y.: Cornell University Press, 1969, p.49).

Physical settings, resources, kinds of personnel, their training and other contextual factors all may influence what an item means in its local setting. Anthropologists have struggled with cross-cultural variations in concepts of illness and treatment for years. One social scientist has even suggested achieving cross-cultural comparability in field research by asking questions in different ways. Even with respect to what a physician is, for example, WHO struggled for years to develop an authoritative definition, finally adopting some banal statement like "a physician is anyone trained for the practice of medicine and admitted or licensed to practice in his or her country". Or as Elling has put it,

> ... Take "a visit". Does one count phone contacts with physician? But what reporting system would accurately cover such contact.
>
> R.H. Elling "Cross-National Study of Health Systems - Political Economic and Health Care". Transaction Books New Brunswick (U.S.A) and (U.K) 1980.

There are gross variations in population census procedures and even in the existance of censuses in many underdeveloped countries. Consequently, many population denominators are only estimates, some of them crude.[5] Birth occurring in remote rural or nomadic populations in many countries will not often be attended by anyone responsible for officially reporting them. The same is true for infant and other deaths in these populations. A crude but for the most part correct generalisation is that the fewer the resources a country has, the less adequate is its statistical system. However, given the efforts of the U.N. systems to improve statistical reporting over several generations, it is probably also true that later figures are more useful than earlier ones. Also, by grouping countries in rather broad categories - for example, "poor", "middle", and "wealthy" on G.D.P. and "low", "medium", and "high" on death rate - differences between categories are more likely to be real than differences of a few points. In any cases, there is no substitute for careful examination of secondary data and possibly using key informants knowledgeable about a country's statistical system and situation to improve the data.

4.4 SUMMARY

In this chapter, by using the causal model (as a guiding tool) introduced in the previous chpater, and also the guidelines put forward by the W.H.O in the issue of "Development of Indicators for Monitoring Progress Towards Health for All by the Year 2000" (WHO 1981a). We have selected some indicators which is believed to determine the level of health in the African Devleoping Countries.

The level of health also has been carefully chosen in order to be more representative of what it should indicate in the LDCs. The level of health has been indicated by the mortality rate (as the indicator of ill-health) and the life expectancy at birth (as the positive measure of level of health). These two indicators have been selected from the various available indicators to serve the above mentioned purpose.

We have brought forward some arguments about the importance and non-importance of culture in comparative studies in the field of health. We established that traditional medicine (in either form, as a valid and respectable practice or as pure charlatanism) is part of the culture and it must have an effect on the healthiness of a nation but due to the lack of data to measure this effect, we decided to minimise it by selecting the countries involved in the study from Africa, knowing that they all practice traditional medicine with some degree of persistency.

Four groups of quantifiable determinants of level of health have been selected. These groups are: those indicating the availability of health care resources, those indicating general socio-economic condition, those indicating demographic conditions and finally, those indicators measuring the effect of government expenditures (on health, education and agriculture) on the health of selected African developing nations.

Each of these indicators belongs to one of the four subsystems (level of recursion) introduced in the chapter three.

In choosing the variables, comprehensive literature was reviewed, and based on revision, the future hypothesis will be set up.

4.5 FOOTNOTES TO CHAPTER FOUR

1. The terms "factor", "variable", and "indicator" are obviously value-added, but for one purpose we have decided to use them intgerchangably that whenever these terms are used their meaning is the same.

2. Here Gish cites Walter Rodney's book. (1974).

3. Gish notes that "in fact, at least in some cases, the introduction of medical missionaries even preceded the coming of the flag".

4. In discussing the results of the study of the cost of health services in the six different countries, Abel-Smith suggests that expenditures on nutritional services should be omitted from future studies because of the difficultuies of reconciling provision in cash with provision in kind. Several borderline cases of goods and services which may or may not be considered health services are noted by Abel-Smith (B. Smith 1963).

5. The U.N. uses a code system to characterise the adequacy of statistical systems of countries and particular indices reported by them. This, in the Demographic Year Book the code "c" indicates complete i.e., at least 90 percent coverage of the population in question by the data presented; the code "u" means unreliable, i.e., less than 90 percent coverage or omission of significant portions of the population; and the symbol ( ) indicates no information concerning quality of data.

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PART TWO

THE HEALTH MODELS AND ASSOCIATED STATISTICAL ANALYSIS

CHAPTER FIVE: JUSTIFICATION OF RESEARCH METHODOLOGY

A problem exists fundamentally when an individual desires something, has alternative ways of unequal efficiency for pursuing the objective and is in doubt about the course of action. Complications arise when the problem belongs not just to an individual but a group of individuals, a whole or a group of nations. Further complexities arise when the environment of the problem and its owner changes in ways that affect the efficiencies of the courses of action or the value of the outcomes. The health problem being addressed in this research is plagued with complexities of multi-ownership and environmental dynamism.

Multi-ownership complexity is considered in this research by selecting for analysis those indicators which are universally considered relevant to the problematic situation. The problem of environmental dynamism however needs to be cautiously approached.

The objective is retentive as well as acquisitive. It is retentive in the sense that resources of value (money, time, energy, equipment, skills, etc.) have to be preserved. It is also acquisitive since the resources for attaining a desirable health status need to be acquired. The dilemma here is therefore in attempting to achieve an analytically optimum but operationally feasible balance between the retentive component (sustaining economic viability) and the acquisitive component (enhancing the quality of life).

It would not be enough to conduct analysis just on the basis of the opportunity - cost or accounting values that could be attached to certain quantitative economic predictions on that indicator. What would be desirable is to develop a conceptual model which is representative of a universally acceptable conception of what indicators (variables) are relevant and how they might be related in any particular situation or economy. Thus we are concerned with the development of a descriptive model obtainable through an exploratory study and which could later (at a second stage of analysis) be used to develop an explanatory model perhaps for decision-making purposes on policy issues.

With the above mentioned consideration in mind, the assumption underlying time-series analysis make the latter undesirable in this research. We are concerned essentially with cross-sectional rather than time-series analysis of available data. It is perhaps stretching the definition of cross-sectional data since the data to be used is a cross-section of states (within a particular region of the globe) at certain points of time during their socio-economic and political developments. Nevertheless, the nature of the problem itself is such that pertinent issues of concern make it imperative to keep analysis within the context of a "holistic" approach to the multi-criteria multi-ownership decision-making situation.

The subject of study is the less-developed world where there is dire need to maintain a retentive as well as acquisitive objective in the pursuance of a desirable "health-status" (as indeed has been propogated in the Alma Ata declaration of "Health for All by the Year 2000"). The six countries chosen for this study are considered by the researcher to be a representative sample of the less-developed world.

The methodology proposed for the analysis in this research can be analogised with "time-slicing" simulation. Parametric statistical analysis is proposed for data obtained (relating to socio-economic development and government fiscal policies) from the selected group of less-developed countries (LDCs) in specific periods of their development. This would be to identify which of the indicators turn out to be "statistically significant". From the relevant indicators of health-status obrained, descriptive and predictive models could be built eventhough they might not necessarily make control possible since they would not be able to explain the performance of any of the health status indicators in any particular country. The preliminary models would however be useful in attempting to analyse and understand the performance of selected indicators for the representative sample as a whole.

The statistical analysis is focussed on the period 1961-1980. This is because the first half of this decade in which the economies concerned were faced with various upheavals due to drastic changes in their component-build up of socio-economic indicators (such as the GDP) and also the physical quality of life index (PQLI).

The indicators used in this analysis are:

- Urbanisation (that is, % of population living in cities),
- Number of primary school students as a % of the population,
- Recurrent expenditures on education per capita,
- Capital expenditures on education per capita,
- Recurrent expenditures on health per capita,
- Capital expenditures on health per capita
- Number of physicians per 10,000 residents,

- Number of nurses and paramedics per 1000 residents,
- Number of hospital beds per 1000 residents,
- GDP per capita, and finally,
- Total agriculture expenditure per capita.

From these indicators, it is expected to develop a model for determining mortality and life-expectancy at birth, these two being perhaps the major component of PQLI (Physical Quality of Life Index) in the less-developed world. Thus we have 11 independent variables and 1 dependent at every stage of the analysis.

For the exploratory study, a regression coefficient is obtained for each independent variable during each period. These coefficients are then used as eighting factors in the second stage of the analysis.

Let $Y_i = \sum_{j=1}^{M} C_{ij}X_j + e_i$ (for any period considered),

where i = 1, ..., n (number of countries being considered)

j = 1, ..., M (number of indicators being considered) and,

e denotes the error term.

The weighting factor of X_j would then be the mean of all of this variable's correlation coefficients obtained for specific periods during the first stage of the analysis.

$$Y = \sum_{j=1}^{M} WjXj + E$$

where, Xj denotes the mean value of indicators for all the countries under consideration.

Thus, it is the results of the first stage of analysis that we expect to use to develop the second stage of analysis.

It must be mentioned that right from the first stage of analysis, it would be essential to consider the spurios effects of some of the variables on certain distinctive groups of other variables in the analysis. For this, partial correlation analysis would need to be conducted. Also, it would be reasonable to suspect problems of multicollinearity but not heteroscedasticity, the latter being obviated by the time-series nature of the data (thereby suggesting that the residuals could be expected to have a common variance). Multicollinearity however refers to a situation where, because of strong interrelationships among the independent variables, it becomes difficult to disentangle their separate effects on the dependent variable. This problem (if encountered) would need to be counteracted through factor analysis, resorting to appropriate axial rotation there necessary as a sort of sensitivity-analysis.

CHAPTER SIX EXPLORATORY ANALYSIS

CHAPTER SIX

EXPLORATORY ANALYSIS

6.1 SALIENT FEATURES OF THE STATISTICAL ANALYSIS

We have two broad objectives in this chapter. First, we wish to determine whether or not there is a correlation between the dependent variables (mortality rate and life expectancy at birth) and various indicators of health matrix. Second, we wish to know the nature of any relationships which are found to exist, that is whether it is direct or inverse and whether it is significant. The particular questions on which we hope our correlation analysis will throw light may be set out as follows:

1. Are the indicators of health matrix correlated with the dependent variables?

2. Is the level of health more responsive to changes in the supply of health services or to changes in the level of national prosperity?

3. Is the level of health more closely related to the number of hospital beds or to the number of physicians?

4. Is the level of health more closely related to the number of hospital beds or to the number of nurses?

5. From the indicators of supply of health services, which one is more related to any change in the level of health?

6. What is the role of education in relation to the level of health?

The selected indicators (which have been converted to quantitative measures), are said to be the principle components or sections of the "health matrix". The health matrix is defined as a frame or type of input-output table in which certain variables, which help either to indicate or to determine, the level of health, are arrayed. The health matrix and the variables in which it is comprised are presented in Table 6.1.

The health matrix variables included in the analysis are:

1. Mortality rate;
2. Life expectancy at birth;
3. Urbanisation;
4. Number of primary students as percentage of population;
5. Recurrent expenditures on education; (government)
6. Capital expenditures on education; (government)
7. Recurrent expenditures on health; (government)
8. Capital expenditures on health; (government)
9. Number of physicians per 10,000 of population;
10. Number of nurses and paramedics per 1000 of population;
11. Number of hospital beds per 1000 of population;
12. Gross domestic product per capita; (G.D.P)
13. Expenditures on agriculture as percentage of G.D.P per capita.

The sources of data for the variables which have been included in the correlation analysis are set out in Appendix A-4 "Sources of data". The period of years concerned and the total number of observations are also set out in this appendix.

Table 6-1 Health Matrix and its Associated Variables

AGR	GDP	BED	NUR	PHY	CEH	REH	CEE	REE	PSP	URB	LEAB	MR	
													MR
													LEAB
													URB
													PSP
													REE
													CEE
													REH
													CEH
													PHY
													NUR
													BED
													GDP
													AGR

Continued.......

Table 6.1 (continued)

Notations

MR = Mortality Rate

LEAB = Life Expectancy at Birth

VRB = Urbanization

PSP = No. of Primary Students as % of Population

REE = Recurrent Expenditures on Education

CEE = Capital Expenditures on Education

REH = Recurrent Expenditures on Health

CEH = Capital Expenditures on Health

PHY = No. of Physicians per 10,000 of Population

NUR = No. of Nurses per 1000 of Population

BED = No. of Hospital Beds per 1000 of Population

GDP = Gross Domestic Product Per Capita

AGR = Government Expenditures on Agriculture

Mid-year population estimates were used to deflate the data. In other words, regardless of whether or not, for example the number of hospital beds related to December 31 of each year or to some other data, the mid-year population estimate was used in all cases. By using mid-year population estimates, we attempted to insure that at least the denominator of the various indicators related to a particular year. The indicators are thus more comparable in describing the number of doctors, or the number of hospital beds, for a particular year, rather than the state at the beginning of one year or the end of the preceding year. One of the chief tests of this study is to set out the statistical relationships which exist between the various pairs of these variables. These relationships are indicated by correlation coefficients are presneted in this chapter.

The theory and method of the correlation analysis are set out in most introductory texts to statistical theory, (for example, see Edwards). We are not certain whether, say, mortality rate is dependent on, say, the number of physicians, or whether the number of physicians is dependent on the rate of mortality. Accordingly, we want to calculate the "correlation coefficient", (r), between our two variables rather than the "regression coefficient". That is, we want to know whether or not one variable tends to move as a consequence of a movement in the other variable.

A correlation coefficient (r) of +1 implies a perfect, direct or positive, correlation; an r of -1 implies perfect inverse or negative correlation; and an r of "0" implies that the two variables are uncorrelated. In addition, r = 0 to +1 implies a tendency to a positive linear association (or correlation) of the variables; and r = 0 to -1 implies a tendency to a negative or inverse linear association of the variables. We may now set out the general subject matter of our study as the investigation of comparative levels of health in relation to the supply of health care facilities, medical manpower, level of national prosperity, and the rest of variables of health matrix.

The complete results of the analysis are presented in Appendix A-6. In addition, significant values of the correlation coefficients are set out. These significant values of (r) are interpreted in the following manner. The null-hypothesis is that the variables are uncorrelated. Given the number of observation, N, P is the probability that a calcualted r will be equal to or greater than the given value of f. For example, when N = 10, the probability of obtaining a correlation coefficient (r) equal to or greater than .7817 is .008. That is, there is only .8 percent chance that a value of r, equal to or greater than .7817, would arise from a random sample of the two variables if the two variables are uncorrelated. Accordingly, if from a sample of 10 observations we obtain an r equal to or greater than .7817 (in a positive or a negative direction), we would reject the null-hypothesis and conclude that the two variables are correlated at the 99.2 percent level of significance, or confidence level.

6.2 APRIORISTIC EXPECTATIONS OF THE RESEARCHER

The variables being examined in this research have been carefully chosen within the limitation of data availability and reliability. We would expect to see a significant relationship (with negative or positive nature accordingly) between the indicators of level of health and most of the independent variables. To be clear, we set out our expectation one by one as follows:

Mortality rate is expected to have strong and negative relationship with the urbanisation. This aprioristic expectation arise when the cases involved in the analysis are from the less-developed world. People living in the urban area are supposed to enjoy receiving more of the luxurious life facilities, (if health facilities and associated factors e.g., better housing, sanitation, clean water, etc. come to these category) than those living in rural areas. Thus, we expect to see a significant and positive relationship between the life expectancy at birth and urbanisation for the above reason.

The extent to which a nation has devoted resources to education is thought to be an important influence on health status, since the more highly educated a population is, the greater the likelihood that public health education programmes (if there is any) will be successful, and therefore the health status of population concerned will increase (meaning that mortality rate decreases and the life expectancy at birth increases). This important influence will become very important and very significant, where there is a proper health education programme (in developed countries), but, we expect to see a moderate relationship between indicators of education and health status, where there is not enough public health education programmes (in less-developed countries).

The fund allocated to health activities are believed to be of greater influence on healthiness of nations, therefore, we expect to see a significant relation between the indicators of health expenditures and the indicators of health status. (Negative relation in the case of mortality rate and positive in the case of life expectancy at birth).

There is always the possibility of a close relationship between the number of physicians and health status of people. After all there is the physician who is directly involved in the betterness of people's health. This relation should be, as we expect, strong and negative in the case of mortality rate as the indicator of level of health and strong and positive in the case of the life expectancy at birth as the indicator of the level of health.

The next two indicators of health (number of nurses per 1000 and nurses of hospital beds per 1000) according to our expectation must have a moderate relation with the indicators of health status. We did suspect the existance of a strong relations between these two sets of variables, although, in the less-developed world the roles of nurses are not very well defined, they are still considered to be a helping hand to the physicians. Without the latter the former still has enormous freedom of activities. This lack of definition applies to hospital beds too. Hospitals are not mostly the kind of places which we expect them to be, but one thing is for sure, they are places that people go to become healthy, therefore, we expect to see a strong relationships between the number of hospital beds and the indicators of level of health.

Because of the uneven distribution of wealth among people of the less developed world, we expect to see a moderate relation between the G.D.P per capita and indicators of health status. And also a strong relation between the government expenditure on agriculture and health status of people.

The above mentioned expectations are briefed in the table 6.2. In this table the expected nature of the relationships between dependent and independent variables are explained. In the table, "0" denotes "No", and "1" means "Yes".

TABLE 6.2

Aprior Expectations of the Result of Correlation Analysis

Between Mortality Rate or Life Expectancy at Birth and

the rest of variables of Health Matrix

EITHER MORTALITY RATE OR LIFE EXPECTANCY AT

BIRTH AS REGRESSAND.

INDICATORS	Sign	APRIORI EXPECTATIONS Significant Effect (.7-1)	Moderate Effect (.45-.69)	Low Effect (0-.44)
Urbanisation	+/-	1	0	0
Primary School pupil	+/-	0	1	0
Ed. Recurrent Exp.	+/-	0	1	0
Ed. Capital Exp.	+/-	0	1	0
Health Recurrent Exp.	+/-	1	0	0
Health Capital Exp.	+/-	1	0	0
Physicians per 10,000	+/-	1	0	0
Nurses per 1000	+/-	1	0	0
Hospital beds per 1000	+/-	1	0	0
G.D.P. per capita	+/-	0	1	0
Agriculure as % of GDP	+/-	1	0	0

Source see text

6.3 FINDINGS

Detiled results of the pearson correlation analysis can be seen in Appendix A-6.[1] When analysing the data for individual countries, the periods under consideration were, 1961-1970, 1971-1980, and 1961-1980. When the aggregate data was analysed, the data under consideration was from the period 1961-80. For the case of each individual country the later period, i.e., 1971-80 will be discussed.

The correlation analysis produced unbiased or biased results depending on how serious was the degree of interdependency of the observations of any one variable. That is, in carrying out the correlation analysis, we have assumed that, with respect to each variable, each observation is independent of the other observations.[2] Athough the number of physicians in any country in any one year may not be completely determined by the number of physicians in the previous year, the number of physicians in any two years are certainly not completely independent of each other. The same can be said of the number of hospital beds, and the number of nurses and midwives.

In setting out these variables on a per capita basis, however, the degree of interdependency between the successive observations of a particular variable is thought to be somewhat diminished. That is, we are suggesting that the interdependency between successive observations of, say, the total number of physicians per 10,000 person, is less than the interdependency between successive observations of the total number of physicians. Nevertheless, the results of the correlation analysis are limited to the extent that a significant interdependency might exist between successive observation of our variables.

Findings are presented in two sections, one section deals with the relationships between dependent variables and independent variables, the second section explains the relationships between different pair of variables of health matrix.

6.3.1 The Relationship Between Dependent and Independent Variables.

We cannot possibly comment on all results of the two variable analysis. For this reason we try to explain those analyses related to the period 1971-80. The reader is thus left to his own interest in tracing the conclusion to be drawn from the detailed studies of individual countries and for the earlier period.

The following are the comparison of expected relationships between dependent and independent variables (see section 6.2) and those of results obtained from the analysis.

In table 6.3 we present a summary of the correlation coefficients between mortality rate and urbanisation, and the number of primary students as percentage of population. As it can readily be seen, most of the r's between mortality rate and urbanisation are negative and are significant at a very high percent of significant level. Strangely enough Mauritius shows a moderate and positive relation which is significant at 2 percent level of confidence. By looking at the data for Mauritius (see Appendix A-3), we notice that the urbanisation declines during the period of the study. If we accept that the decrease shown in data is corect, we could include that there is a negative and significant correlation between

Table 6-3

Correlation coefficient between mortality rate and certain variables of health matrix

Mortality Rate and

COUNTRY	URB		PSP		N
	r	p	r	p	
Botswana	-.9044	.000	-.9336	.000	10
Kenya	-.9955	.000	-.8393	.002	10
Mauritius	.6568	.002	.6132	.059	10
Nigeria	-.9643	.000	-.7802	.003	10
Swaziland	-.8167	.004	-.9092	.000	10
Tanzania	-.9836	.000	-.9504	.000	10
All countries	-.7814	.000	-.5950	.002	24

URB = URBANISATION

PSP = PRIMARY STUDENTS AS PERCENTAGE OF POPULATION

Period: 1971-80.

N = Number of observations.

P = Level of Significance (.000 indicates a high level of significance exists).

Source: See text.

mortality rate and urbanisation, if, and only if, they both decrease. If we suspect the validity of Mauritius data, we therefore can conclude that there is a negative and significant relation between urbanisation and mortality rate.

Mortality rate and the number of primary student as percentage of population have followed the same pattern, as it can be seen from table 6.3, again this is the Mauritius result which makes the conclusion debatable. The graphical representation of data in Appendix 3 shows that once again the number of students as percentage of population for Mauritus declines during the period of the study. We can cautiously conclude that there is negative relationship between mortality rate and the number of primary students as percentage of population, which is in line with our aprioristic expectation.

From our result, however, we are unable to conclude whether or not there is a higher negative correlation between mortality rate and urbanisation or between mortality and the number of primary students.

The correlation coefficients between the second indicator of the level of health, i.e., the life expectancy at birth, and urbanisation and the number of primary students as percentage of population show exactly the same result, as the first indicator of level of health with the two above mentioned indicators (see table 6.4), except for the sign which is positive in most cases. Mauritius shows the negative sign and again if we accept that the Mauritus data are wrong we therefore, can conclude that there is a positive relation between the life expectancy at birth and urbanisation and also the same sort of relation exists between life expectancy at birth and

Table 6-4

Correlation coefficient between life expectancy at birth and certain variables of health matrix

Life expectancy at birth and

COUNTRY	URB		PSP		N
	r	p	r	p	
Botswana	.8499	.002	.9110	.000	10
Kenya	.8688	.001	.8131	.004	10
Mauritius	-.8479	.002	-.8558	.002	10
Nigeria	.8853	.001	.8055	.009	10
Swaziland	.9043	.000	.8729	.001	10
Tanzania	.8991	.000	.9028	.000	10
All countries	.7635	.000	.5931	.002	24

URB = URBANISATION

PSP = PRIMARY STUDENTS AS PERCENTAGE OF POPULATION

Period: 1971-80.

N = Number of observations.

P = Level of significance (.000 indicates a very high level of significance exists).

Source: See text.

the number of students. However, it is difficult to conclude which one of the independent variables have a higher negative correlation with the dependent variables.

The results obtained were not far from our expectations, we expected to see the high and negative relationships between mortality rate and urbanisation, that was proved to be correct except in the case of Mauritius. For the life expectancy at birth, this relation was expected to exist but with a positive sign, again that was proved to be correct except for Mauritus. The results of aggregate data for all the countries, however, show a negative coefficients between these two set of variables, which is in line with our expectation.

We expected to see a moderate relationships between the number of students and the indicators of level of health, with the negative nature, in the case of mortality, and with positive sign in the case of life expectancy at birth. The analysis showed a more significant result. However, the results of aggregate data prove the expectation right despite the fact that Mauritius was behaving differently (see tables 3 and 4).

Table 6.5 shows the relationships between mortality rate and recurrent expenditures on education, capital expenditures on education, recurrent expenditures on health and capital expenditures on health.

As it can be seen from table 6.5. The signs of coefficients between mortality rate and expendtiures on health and education are negative. Therefore, we can conclude that, there is a negative correlation between mortality rate and expenditures on education and health.

Table 6-5

Correlation coefficient between mortality rate and certain variables of health matrix

Mortality Rate and

COUNTRY	ERE		ECE		HRE		HCE		N
	r	p	r	p	r	p	r	p	
Botswana	-.8523	.002	-.7817	.008	-.7161	.020	-.6845	.029	10
Kenya	-.9729	.000	-.8436	.002	-.9649	.000	-.9373	.000	10
Mauritius	-.9886	.073	-.5567	.095	-.5141	.129	-.7025	.023	10
Nigeria	-.8913	.001	-.7742	.014	-.7223	.018	-.5059	-.136	10
Swaziland	-.7823	.013	-.8226	.006	-.7841	.007	-.1030	.777	10
Tanzania	-.9151	.000	-.8181	.004	-.9526	.000	-.8345	.005	10
All countries	-.5240	.009	-.2096	.326	-.5861	.003	-.1547	.471	24

ERE = RECURRENT EXPENDITURES ON EDUCATION
ECE = CAPITAL EXPENDITURES ON EDUCATION
HRE = RECURRENT EXPENDITURES ON HEALTH
HCE = CAPITAL EXPENDITURES ON HEALTH

Period: 1971-80.
N = Number of observations.
P = Level of significance (.000 indicates a very high level of significance exists)

Source: See text.

We hypothesised that there is a moderate and negative relationship between mortality rate and expenditures (capital and recurrent) on education by government. The result showed that five countries out of six proved us wrong by having significant and negative relation with education expenditure. The sixth country, namely, Mauritus showed a moderate but negative result.

We expected to see a strong and negative relationship between mortality rate and expenditures on health (recurrent and capital). The relationship between recurrent expenditure on health and mortality rate proved to be strong and negative, Mauritus showed amoderate and negative sign. Capital expenditure for all the cases showed a negative sign, but the magnitude of the coefficients for all the countries were not large. Swaziland showed insignificant almost non-consistent relation, Nigeria and Botswana showed a moderate and negative relation, the rest lined up to our expectation.

Again, from our results, we are unable to conclude whether or not there is a higher negative correlation between mortality rate and expenditures on education or between mortality and expenditures on health.

Table 6.6 shows the results of correlation analysis between life expectancy at birth and recurrent expenditures on education, capital expenditures on education, recurrent expenditures on health, and capital expenditures on health.

Table 6-6

Correlation coefficients between life expectancy at birth
and certain variables of health matrix

Life Expectancy At Birth

COUNTRY	ERE		ECE		HRE		HCE		N
	r	p	r	p	r	p	r	p	
Botswana	.8654	.001	.5299	.115	.7737	.009	.6310	.50	10
Kenya	.7654	.010	.5047	.137	.7603	.011	.8044	.005	10
Mauritius	.8724	.001	.7273	.017	.8976	.000	.6495	.042	10
Nigeria	.8409	.005	.8550	.003	.8007	.005	.7934	.006	10
Swaziland	.7630	.017	.6787	.044	.8592	.001	.1912	.597	10
Tanzania	.8745	.001	.7767	.008	.8279	.006	.7642	.016	10
All countries	.5820	.003	.2008	.347	.6308	.001	.1554	.468	24

ERE = RECURRENT EXPENDITURES ON EDUCATION
ECE = CAPITAL EXPENDITURES ON EDUCATION
HRE = RECURRENT EXPENDITURES ON HEALTH
HCE = CAPITAL EXPENDITURES ON HEALTH

Period: 1971-80.
N = Number of observations.
P = Level of significance (.000 indicates a very high level of significance exists)

Source: See text.

We expected to see a moderate and positive relation between the expenditures on education and the life expectancy at birth. The obtained correlations between recurrent expenditures and life expectancy at birth were shown to be positive and significant. Again it is more than what we expected, but the most important factor is the sign which is positive in all the cases.

The relationship between capital expenditures on education and life expectancy at brith are from positive nature, and with different magnitude. The magnitude of coefficients were large for the case of Mauritus, Nigeria, and Tanzania, and moderate for the case of Botswana, Kenya, and Swaziland.

Health expenditures are expected to have a positive and strong correlation with the life expectancy at birth. This expectation was shown to be correct for the recurrent expenditures and the life expectancy at brith. Capital expenditures on health showed different relation, meaning that only the sign was as we expected (i.e, positive). Botswana and Mauritus showed a moderate correlation and Swaziland showed a very non;significant relation.

From the results obtained, we can therefore conclude, that there is a positive correlation between the life expectancy at birth and expenditures on health and education (by government).

As for the variables describing availability of health care resources, the number of physicians per 10,000 of people was expected to be negatively related to mortality rate. As it can be seen from table 6.7,

Table 6-7

Correlation coefficient between mortality rate and certain variables of health matrix

Mortality Rate and

COUNTRY	PHY		NUR		BED		N
	r	p	r	p	r	p	
Botswana	-.8654	.001	-.8570	.002	-.9062	.001	10
Kenya	.8936	.000	-.8544	.002	-.6922	.027	10
Mauritius	-.4330	.211	-.5876	.074	.6327	.050	10
Nigeria	-.7285	.017	-.7193	.019	-.9601	.000	10
Swaziland	-.4336	.211	-.9322	.000	.3926	.296	10
Tanzania	-.7521	.012	-.9631	.000	-.9703	.000	10
All countries	-.7837	.000	-.7363	.000	.0311	.885	24

PHY = NUMBER OF PHYSICIANS PER 10,000 OF POPULATION
NUR = NUMBER OF NURSES PER 1,000 OF POPULATION
BED = HOSPITAL BEDS PER 1,000 OF POPULATION

Period: 1971-80.
N = Number of observation.
P = Level of significance (.000 indicates a very high level of significance exists).

Source: See text.

of six countries involved in the analysis, three showed significant and negative relation, two others, namely Mauritus and Swaziland, was shown to have moderate and negative relation, and strangely enough Kenya showed that mortality rate and the number of physicians per 10,000 of people have positive and significant relation. The mixed results obtained prevent us to make any general conclusion regarding these two variables, for each individual country. However, the results of aggregate data show the negative coefficients, which is what we have expected.

Table 6.7 shows that, the number of nurses and paramedic, have an important influence on level of mortality. All of the countries involved in the analysis, except Mauritius, showed to have a negative and significant relations for the two variables concerned. Mauritius showed a moderate and negative relation.

Our expectation was to see a strong but negative relationship between the number of hospital beds per 1,000 of population and mortality rate. The correlation coefficients between these two variables are of a mixed nature. Although in three cases, namely, Botswana, Nigeria, Tanzania the result showed a significant and negative relation, Kenya showed a moderate and negative relation, and furthermore, Swaziland and Mauritus showed a complely different relation meaning that the sign was positive (see table 6.7). The rapidly decreasing number of hospitals and hospital beds due to the old age of buildings and not being properly replaced, or failure to keep pace with an expending population, therefore, is probably the principle reason for the positive correlation coefficients between mortality rate and the number of hospital beds for 1,000 of persons.

Table 6-8

Correlation coefficient between life expectancy at birth and certain variables of health matrix

Life expectancy at birth and

COUNTRY	PHY		NUR		BED		N
	r	p	r	p	r	p	
Botswana	.8914	.001	.8936	.000	.8130	.008	10
Kenya	-.8864	.001	.8816	.001	.7651	.010	10
Mauritius	.9222	.000	.7900	.007	-.8758	.001	10
Nigeria	.8174	.004	.8444	.002	.8201	.004	10
Swaziland	.7282	.017	.8381	.002	-.1807	.642	10
Tanzania	.8118	.004	.9070	.000	.8954	.000	10
All countries	.8320	.000	.7651	.000	-.0697	.746	24

PHY = NUMBER OF PHYSICIANS PER 10,000 OF POPULATION
NUR = NUMBER OF NURSES PER 1,000 OF POPULATION
BED = HOSPITAL BEDS PER 1,000 OF POPULATION

Period: 1971-80.
N = Number of observation.
P = Level of significance (.000 indicates a very high level of significance exists).

Source: See text.

From the three indicators of health facilities, only the number of nurses showed the expected sign. Therefore we can conclude that there is a negative correlation between the number of nurses and mortality rate. In the absence of a uniformal result for the number of physicians and number of hsopital beds we cannot arrive at any sort of conclusions for each individual country, but the results of aggregate data suggests a negative relationship between mortality rate and number of physicians.

Table 6.8 is representing the results obtained from the analysis between the life expectancy at birth and the number of physicians per 10,000 of population, the number of nurses per 1,000 of population and the number of hospital beds.

The relationship between the life expectancy at birth and the number of physicians per 10,000 of people was shown to be positively significant except for the case of Kenya which was negatively significant. This negative correlation may be due to rapid increase in the number of people, or to immigration of physicians to the other countries, however, due to this contravency of the result we cannot make any general conclusion.

The correlation coefficients between the life expectancy at birth and the number of nurses per 1,000 of peolle showed a positive and significant coefficients for all the countries involved in the study (see table 6.8).

Table 6-9

Correlation coefficient between mortality rate and certain variables of health matrix

	Mortality Rate and				
COUNTRY	GDP		AGR		N
	r	p	r	p	
Botswana	-.8411	.004	-.4124	.236	10
Kenya	-.9867	.000	-.6367	.048	10
Mauritius	.6645	.051	.2769	.439	10
Nigeria	-.9301	.000	-.9084	.000	10
Swaziland	-.9486	.000	-.3676	.296	10
Tanzania	-.9466	.000	-.5333	.112	10
All countries	-.5033	.012	-.5208	.009	24

GDP = GROSS DOMESTIC PRODUCT PER CAPITA

AGR = AGRICULTURE EXPENDITURE AS PERCENTAGE OF GDP

Period: 1971-80.

N = Number of observation.

P = Level of significance (.000 indicates a very high level of significance exists)

Source: See text.

Turning to the correlation coefficients betweeen the number of hospital beds and the life expectancy at birth, we witnessed a mixed result. Four of the countries involved in the study showed positive and strong relationships, one namely Mauritius showed negative and significant relationships and the last one (Swaziland) showed a negative and very insignificant correlation. Once again the negative coefficients may be the result of popualtion growth or, close down of hospitals, in any case we cannot conclude a firm relationship between these two variables.

From the three indicators of health services facilities, only the number of nurses fulfilled our expectation, and it was the only indicator from this category which we could raw a conclusion. That is, we can conclude that there is a positive correlation between the life expectancy at brith and the number of nurses per 1,000 of population.

However, the results of aggregate data suggests the lack of relationship between number of hospital beds and the indicators of level of health. (See tables 6.7 and 6.8). The result obtained contradicts the so called aprioristic expectation of the present study and also deny the findings of the research such as Fraser (1973) who established a strong negative relationship between indicator of level of health and number of hospital beds. Notes must be taken that in his study Fraser used infant mortality rate as the indicator of level of health.

Table 6.9 shows the result of correlation coefficients analysis between the mortality rate, and gross domestic product per capita and expenditures on agriculture by government. As it was mentioned before we do not expect to see a significant relationship between gross domestic

Table 6-10

Correlation coefficient between life expectancy at birth and certain variables of health matrix

Life expectancy at birth and

COUNTRY	GDP		AGR		N
	r	p	r	p	
Botswana	.7153	.030	.5824	.077	10
Kenya	.7396	.023	.4367	.207	10
Mauritius	.1569	.687	.0957	.793	10
Nigeria	.9110	.000	.9012	.000	10
Swaziland	.8124	.008	.5890	.073	10
Tanzania	.8153	.007	.5688	.086	10
All countries	.5250	.008	.5480	.006	24

GDP = GROSS DOMESTIC PRODUCT PER CAPITA

AGR = AGRICULTURE EXPENDITURES AS PERCENTAGE OF GDP

Period: 1971-80.

N = Number of observations.

P = Level of significance (.000 indicates a very high level of significance exists)

Source: See text.

product per capita and mortality rate. But what we would like to be witness of, was to see a moderate and negative relations between these two variables. Again except for Mauritius the result of the other five countries were uniformal, meaning that the coefficients proved to be negative and significant. Mauritus showed a moderate and positive correlation.

Strong and negative relationship were expected from the relationships between mortality rate and expenditures on agriculture as percentage of G.D.P for the countries involved in the analysis. That proved to be right only for Nigeria. Kenya, and Tanzania showed a weak and negative relation. The relationship for Swaziland and Botswana were weak and negative, and for Mauritius the coefficient shows a positive sign with a very weak magnitude. Again we cannot arrive to a set of conclusion about the existed relationships between the two set of variables concerned. (See table 6.9).

The correlation coeffients obtained from the correlation coefficient analysis of the life expectancy at birth and gross domestic product per capita, and expenditure on agriculture as percentage of G.D.P. are shown in table 6.10. As it can be readily seen, all of the r's between the life expectancy at brith and G.D.P per capita and the expenditure on agriculture are positive. G.D.P showed a positive and strong relationship in connection with the life expectancy at birth for five of the countries involved in the analysis, for the sixth one (Mauritius) the relationship was positive and almost non-existent.

Expenditure on agricultures and the life expectancy at birth should have a positive and significant relation with each other according to

Table 6-11

Correlation coefficient between various

pairs of variables of health matrix

Mortality Rate and

Life expectancy at birth

COUNTRY	r	p	N
Botswana	-.8644	.001	10
Kenya	-.8314	.003	10
Mauritius	-.2205	.540	10
Nigeria	-.8346	.003	10
Swaziland	-.7964	.006	10
Tanzania	-.8834	.001	10
All countries	-.9803	.000	24

N = Number of observation

r = Correlation coefficient

p = Level of significance (.000 indicates a very high level of significance exists)

Source: See text.

our expectations. The obtained result showed that the only country which fulfilled our expectation was Nigeria, Mauritus showed no relation at all, the other four showed a positive and moderate relation.

From the result, we can therefore conclude that, there is a positive coefficient between the life expectancy at birth and the G.D.P per capita and expenditures on agriculture.

From the results, however, we are able to conclude that there is a higher negative correlation between the life expectancy at birth and G.D.P per capita than between the life expectancy at birth and expenditures on agriculture.

6.3.2 The Relationships between various pairs of variables of the health matrix.

It is worthwhile looking at some of the relationshuips between various pairs of health matrix, not necessarily those of the dependent and independent variables, but those which we have thought to be interesting.

First of all we would like to see the relationships between the indicators of level of health i.e., mortality rate and the life expectancy at birth. Table 6.11 shows the correlation coefficients between these two variables. Significant values of r, corresponding to the observations are set out. Taking the correlation coefficients of -.8644, as obtained from the Botswana data on mortality rate and life expectancy at birth, we find that it is significant at the .01 level of significance. Translating these conclusions into terms of confidence levels, we can say that the r of -.8644 is significant at the 99 per cent confidence level; that is, from a set of 10 observations, there is a 99 per cent chance that an r of 0.8644 implies negative correlation. Conversely, there is a 1 per cent chance that the r of -.8644 implies that these two variables are non-correlated.

To repeat, in testing the significance of any particular correlation coefficient, we assume that the null-hypothesis holds. That is, we assume that there is no correlation between the two variables. We then as the question: "What is the probability orchance of obtaining an r as large or larger (in either a negative or a positive direction) as the r that we have in fact obtained from the given number of observations," This t-distribution test is based essentially on the number of observations.

With reference to the correlation coefficient between mortality and life expectancy at birth as obtained from the Botswana data of 10 observations, the significant value of r, at P = .01 is -.8644. The significant value of .8644 at P = .01 means that there is a probability of .01 that an r of .8644 or larger could be obtained from the correlation of 10 observations of a non-correlated population of the two variables. Accordingly, if we did obtain an r of .8644 or larger, we would conclude that at the .01 probability level, confidence level or significance level, or at the 99 per cent confidence or significance level that our r was significant; that is, we would conclude that there was a positive correlation between the two variables.

Looking first at the correlation coefficients between mortality rate and life expectancy at birth in table 6.11, we can see that all the obtained r's are significant at 94 per cent level of confidence except

Mauritius which shows a very low coefficients. However, from the result of aggregate data we can conclude that, then, that there is a negative correlation between mortality and life expectancy at birth.

In table 6.12, we present a summary of the result of the correlation analysis between the number of physicians and gross domestic product per capita, the number of nurses per 1000 of population, and finally the number of hospital beds per 1000 of people. The result of correlation coefficients between number of physicians and GDP is shown to be with a mix nature. Kenya is showing a negative sign while the rest are showing positive sign the aggregate result also shows a positive sign. Correlation coefficient between the number of physicians and the number of nurses again shows a negative sign for Kenya and positive for the others. Correlation coefficients between the number of physicians and the number of hospital beds yeilds mixed conclusions. Tentatively, we may say that in most countries, the number of physicians is positively correlated with Gross Domestic Product per capita and in most countries positively correalted with the numbers of nurses. A look at the correlation coefficients obtained from the aggregate correlation confirms this tentative conclusion.

Table 6.13 shows the results of analysis between Gross Domestic Product and the number of physicians, the number of nurses, the number of hospital beds, and finally the expenditures on agriculture.

Again we may tentatively, say that G.D.P is positively correlated with the number of physicians, the number of hospital beds, and the number of nurses. The aggregate correlation confirms this tentative conclusion. But we definitely can conclude that; the Gross Domestic Product is positively correlated with the expenditures on agriculture.

Table 6-12

Correlation coefficients between the number of physicians per 1000 of people and certain of the variables of health matrix

Physicians per 10000 persons

COUNTRY	GDP		NUR		BED		N
	r	p	r	p	r	p	
Botswana	.9441	.000	.9754	.000	.8932	.001	10
Kenya	-.8913	.001	-.9392	.000	-.7224	.018	10
Mauritius	.1293	.740	+.9263	.000	-.9014	.000	10
Nigeria	.8931	.001	.9617	.000	.7546	.012	10
Swaziland	.4686	.203	.5446	.104	-.2606	.498	10
Tanzania	.8098	.008	.8675	.001	.8130	.004	10
All countries	.5920	.002	.7687	.000	.0087	.968	24

PHY = NUMBER OF PHYSICIANS PER 10,000 OF POPULATION
GDP = GROSS DOMESTIC PRODUCT PER CAPITA
NUR = NUMBER OF NURSES PER 1,000 OF POPULATION
BED = HOSPITAL BEDS PER 1,000 OF POPULATION
N = Number of observations
P = Level of significance (.000 indicates a very high level of significance exists)
Period = 1971-80
Source: See text

Table 6-13

Correlation coefficients between the GDP per capita and

certain of the variables of health matrix

GDP and

COUNTRY	PHY		NUR		BED		AGR		N
	r	p	r	p	r	p	r	p	
Botswana	.9441	.000	.8819	.002	.8587	.003	.2286	.554	10
Kenya	-.8913	.001	.8540	.003	.6334	.067	.9733	.000	10
Mauritius	.1293	.740	-.1025	.793	.2155	.578	.9161	.001	10
Nigeria	.8931	.001	.8801	.001	.9124	.000	.4886	.000	10
Swaziland	.4686	.203	.9544	.000	-.3860	.305	.9755	.000	10
Tanzania	.8078	.008	.9676	.000	.9679	.000	.4887	.000	10
All countries	.5920	.000	.7014	.000	.3827	.065	.9455	.000	24

PHY = NUMBER OF PHYSICIANS PER 10,000 OF POPULATION
GDP = GROSS DOMESTIC PRODUCT PER CAPITA
NUR = NUMBER OF NURSES PER 1,000 OF POPULATION
BED = HOSPITAL BEDS PER 1,000 OF POPULATION
AGR = GOVERNMENT EXPENDITURE ON AGRICULTURE
N = Number of observations.
Period: 1971-80
P = Level of significance (.000 indicates a very high level of significance exists)
Source: See text

6.4 SUMMARY

In this chapter we have given the reasons to carry out the statistical analysis. We have set up the research hypothesis in the form of expectations, those expectations are presented in section 6.2

We also hoped to shed light on the questions of relationshps between the dependent variable(s) and independent variables.

The answers to the questions (which are set out at the beginning of this chapter, section 6.1) could be given as follows:

1. With response to the question one (Are the indicators of Health Matrix correlated with the dependent variables) we have determined that some form of correlation exists. The detailed discussion about the existing relations is given in the previous section (section 6.3 Findings).

2. The indicators of supply of health services did not respond equally to the dependent variables. From these given indicators only the number of nurses for 1,000 of population was showing a strong relation with both of the dependent variables. Correlation between G.D.P per capita and the indicators of level of health was shown to be significant in most of the cases. We can conclude that the level of health is more responsive to changes in the G.D.P per capita, and changes in the number of nurses than to any changes in the value of the other two i.e., the number of physicians per 10,000 and the number of hospital beds per 1,000.

3. From the analysis, it is evident that the number of physicians is more closely related to the level of health than the number of hospital beds per 1,000.

4-5. As it was mentioned earlier, the number of nurses per 1,000 of population is by all means closely related to the level of health than the other two indicators of supply of health services.

6. The number of primary students as the indicator of literacy was shown to be closely related to the level of health for most of the cases. "More educated the people are, healthier they are". This can be concluded.

6.5 FOOTNOTES TO CHAPTER SIX

1. The statistical analysis is done on the Harris 300 (NEWBURY) computer in The University of Aston.

2. This assumption and the other assumptions implicit in the linear correlation analysis are set out by J.F. Kenney and E.S. Keeping in Mathematic of Statistics, part one (New York: D. Van Nostrand Co. Inc., 1959, p.265).

6.6 REFERENCES

1. Eswards, Allan L. (1979) <u>Multiple Regression and the Analysis of Variance and Covariance</u>. W.H. Freeman and Company, San Francisco, 1979.

2. Kenney, J.F., and E.S. Keeping (1959) <u>Mathematics of Statistics part one</u> New York,: D. Van Nostrande Co. Inc., 1959.

CHAPTER SEVEN: EXPLANATORY ANALYSIS

CHAPTER SEVEN

EXPLANATORY ANALYSIS

7.1 INTRODUCTION

In this capter, we try to develop a model to enable us to enhance the future level of health in the less developed countries by using some African countries as the basis for developing the model.

Even when no sensible physical relationship exists between the variables, we may be able to relate them in some sort of quantitative manner. While a mathematical equation might be physically meaningless, it may nevertheless be extremely valuable for predicting the values of some variables from knowledge of other variables, perhaps under certain understood restrictions.

7.2 SALIENT FEATURES OF THE STATISTICAL ANALYSIS

The health models to be developed will be based on multiple regression. Hence, it is necessary to discuss at this stage the salient features of multiple regression and the manner in which the interpretation of the results obtained will be useful.

Multiple regression is an extention of the use of bivariate correlation coefficients to multivariate analysis. The basic concept is to produce a linear combination of independent variables which will correlate as highly as possible with the dependent variable. The obtained residual (which is the difference between the value of the dependent variable and the value predicted by the linear combination of the independent variables) is assumed to have mean zero with its standard deviation being the smallest possible for any linear combination of the given independent variables. Although the theory implies that the dependent variable depends on all the given independent ones, in practice not all the coefficients of the independent variables can be estimated with any reasonable precision. In considering which variables to include and which to exclude in order to achieve an acceptable level of precision, there are procedures already developed but which do not all give the same final answers. The selection of which procedure to use plays a major role in this research essentially because of the nature of the objective (elaborated upon in the previous chapter).

The procedures available for the selection of variables are:

- all possible regressions;

- backward-elimination or step-down regressions,
- forward-elimination or step-up regressions,
- step-wise regressions, and finally,
- optimum regressions.

In these procedures, selection of variables to include in the model is based on one or more of the following criteria:

a) maximising adjusted multiple correlation,

b) minimising the estimate of the residual variance,

c) maximising simple correlation and partial correlation,

d) maximising the t-ratios or f-ratios.

Backward-elimination, forward-elimination and step-wise regression would not be of much use in this research since none of them guarantees that the set of variables finally arrived at would be optimal in the sense of minimising the residual sum of squares for that number of explanatory variables.

Furthermore, step-wise procedures have been shown (Lindley 1968) to invalidate the usual statistical tests of significance since the procedures involve applying repeated tests to the same data thereby making unclear what probabilities to attach to the confidence-interval statements and tests made on the model finally arrived at.

The above considerations also rule out optimum regression procedure since the latter utilises step-wise regression to "filter" which regressors to use finally in an "all possible regressions" procedure.

The "all possible regressions" procedures is based on criteria (a) and (b) mentioned above. This procedure affords, where necessary the luxury of exercising some judgments in the selection of variables after examining at each stage whether the equation estimated makes sense (that is, how meaningful are the signs and magnitude of the coefficients and the analysis of the residuals). Usually the drawback of this procedure lies in the computer time which builds up rapidly if the number of regressors is large. However, since the maximum number of regressors used in this research is 11, the total number of regressions to be run is only of the order of $2^{11} - 1 = 2047$ requiring a CPU time of not more than .20 seconds. Consequently the "all possible regressions" procedure seems the only logical approach to use for our analysis. Also, some consideration needs to be given to the wide variety of relationships to be expected between the t-ratios and the f-ratios in any regression analysis. These relationships fall into six distinctive cases depending on how significant are the multiple correlation R^2 and the beta-coefficients associated with each observation. These cases are summarised in the table 7.1 below:

Table 7.1

Different categories of relationship between R^2 and beta-coefficients

	R^2 Significant?	Beta-coefficient Significant?
Case 1:	Yes (all)	Yess (all)
Case 2:	Yes (all)	Yes (but not all)
Case 3:	Yes (all)	None
Case 4:	None	Yes (all)
Case 5:	None	Yes (but not all)
Case 6:	None	None

Source: See text.

The relevance of beta-coefficients can be seen in the fact that, what the usual regression coefficients measure is the change in the explained (dependent) variable for unit change in each explanatory (independent) variable holding other variables constant, whereas what the beta-coefficients measure is the change in the explained variable (in standard deviation units) for unit change in each explanatory variable (also in standard deviation units) holding other variables constant.

Case one would not present any problem unless some coefficients had signs opposite to what was expected on the basis of economic theory. Cases two, four and five would not present serious problems since the number of regressors in this research is limited to 11 and the "all possible regressions" procedure is proposed thereby leaving room to exercise judgment, where necessary, on which non-significant variables to drop at any stage of the analysis. Case three would not be problematic in the second stage of analysis since whichever independent variables involved would be treated according to the results from factor analysis done in the first stage of the research. Finally case six could be dismissed since otherwise the regression equation would obviously be useless.

7.3 APRIORISTIC EXPECTATIONS OF THE RESEARCHER

In most less-developed countries, policy-making to enhance the quality of life (especially the health status) has always involved estimating the behaviour of the social systems concerned by contemplation, policitical discussions, arguments and guesswork. In the end, the power structure and the personal goals and welfare of the policy-makers have always dictated the type of policy, its dimension and the direction of its implementation. In recent years however, pressures from international bodies (such as WHO, UNIDO, WORLD BANK, ILO, etc) have tended to have indirect but considerable effect on policy formulation and implementation in these countries mainly due to the large extent of international fund-raising and/or trading involved. Nevertheless, aprioristic expectations of any model which is aimed at futuristic desired states are most likely to be completely different from what would be expected if such models were to be applied in any developed economy.

The independent variables being considered in this research have been cautiously chosen within the constraints of data availability and reliability and also bearing in mind the capability of the intended end-user of the developed model. However, since some of the independent variables themselves would sometimes be forecast value, any expectations regarding their behaviour in the developed model would have to relate to their associated variances. The variables in this category are urbanisation, number of primary school students as percentage of population, number of physicians per 10,000 population and number of nurses and paramedics per 1000 population.

Mortality would normally be expected to be inversely proportional to most of the independent variables. For example, it is expected that any increase in urbanisation could mean decreased mortality rate (or increased life-expectancy at birth), since in LDCs the benefits from any economic growth tend to be concentrated much more in urban than in rural areas. Similar arguments can be put forward for all the other independent variables. On the other hand however, the effect of any changes in variables such as urbanisation, GDP, etc would depend on the degree of urban development, environmental protection, the industrialisation - element of GDP, and general welfare distribution in the economy.

7.4 FINDINGS

7.4.1 General Observations

The tables (7.2 and 7.3) presented below are to illustrate the results obtained from multiple regression during the second stage of analysis.

Using the above tables, the sign of the regular regression coefficient may be interpreted with confidence in those cases where the standard error is much smaller in magnitude than the regular regression coefficient. Where however, the standard error is nearly as large as the regular regression coefficients, the latter would have to be interpreted with caution since there would be a significant chance (at least 15%) that the true regression coefficient might be of the opposite sign to the calculated value due to random errors in the data.

Particular note would also need to be taken of situations where the multiple correlation coefficients R and the simple correlation coefficients r are of opposite signs. Any such situation would seem to indicate that the other regressors have considerable spurious effect on the relationship between the regressand and the particular regressors whose simple (r) is being considered.

The regressors all taken together explain 96.38% of the variation in Mortality Rate. For Life Expectancy At Birth, the percentage variation explained is 97.69%. In the case of mortality rate, the correlation between the regresssand and the individual regressors after removing the

Table 7.2

Results of multiple regression analysis

MORTALITY RATE AS REGRESSAND

	Regular regression coefficients	Standard Error	Multiple R	Simple r
Constant			23.17720	
Variables				
Urbanisation	-.438	.073	.833	-.781
Primary school pupils	-.165	.185	.957	-.595
Educ. Recurrent Expenditure	-.051	.154	.964	-.524
Educ. Capital Expenditure	.168	.285	.963	-.210
Health Recurrent Expenditure	.066	.443	.964	-.586
Health Capital Expenditure	.212	.376	.962	-.155
Physicians per 10,000	2.020	1.236	.784	-.784
Nurses per 1,000	-.164	.383	.963	-.736
Hospital beds per 1,000	2.059	.464	.898	.031
Agriculture Exp. Per Capita	-.001	.000	.947	-.521

Source: See text.

Table 7.3

Results of multiple regression analysis

LIFE EXPECTANCY AS REGRESSAND

	Regular regression coefficients	Standard Error	Multiple R	Simple r
Constant			40.07694	
Variables				
Urbanisation	.593	.091	.896	.764
Primary school pupils	.154	.219	.869	.593
Educ. Recurrent Expenditure	.297	.239	.975	.582
Educ. Capital Expenditure	-.417	.579	.973	.201
Health Recurrent Expenditure	-.467	.517	.976	.631
Physicians per 10,000	-1.825	1.528	.832	.832
Nurses per 1,000	.274	.556	.977	.765
Hospital beds per 1,000	-3.231	.684	.939	-.070
GDP per capita	-.005	.016	.977	.525
Agriculture Exp. Per Capita	.001	.000	.962	.548

Source: See text.

effect of the other regressors is not only much smaller in most cases, but also of opposite sign in all cases but one (see Tables 7.2 and 7.3). It could be argued then that most of the regressors should have been considered as "deflators" rather than as extra variables - which undoubtedly, would have been meaningless since all the regressors have already been deflated by the mid-year population. In the case of "Life Expectancy At Birth", only "Hospital beds per 1000" shows "multiple-R" of opposite sign to the corresponding "simple -r". Indeed, whether the regressand is mortality rate or life expectancy at birth, the behaviour of hospital beds per 1000 is notably far from expectation. This regressor would, nevertheless, still be inappropriate to use as a deflator.

In model interpretation and usage therefore, it is vital to consider the following inherent two-fold problem:

- What is the effect of any "abnormal" behaviour of certain regressors on all the other regressors and also on the regressand?

- What might have been the cause of the "abnormal" behaviour of the regressors concerned?

In answering the first question, the effect can be seen, for many of the regressors in this study, in the relatively large magnitudes ofthe standard errors and also in the sign of the multiple-R being opposite to that of the simple-r.

The second question however is much more difficult to answer. The following tables (table 7.4, 7.5 and 7.6) represent a checklist for

Table 7.4

Apriori expectations of the relationships between regressor and regressand

EITHER MORTALITY RATE OR LIFE EXPECTANCY AT BIRTH AS REGRESSAND

APRIORI EXPECTATIONS

	SIGN	Significant Effect (.7 - 1)	Moderate Effect (.45 - .69)	Low Effect (.45)
Urbanisation	-/+	1	0	0
Primary school pupils	-/+	0	1	0
Edn. Recurrent Expenditure	-/+	0	1	0
Edn. Capital Expenditure	-/+	0	1	0
Health Recurrent Expenditure	-/+	1	0	0
Health Capital Expenditure	-/+	1	0	0
Physicians per 10,000	-/+	1	0	0
Nurses per 1,000	-/+	1	0	0
Hospital beds per 1,000	-/+	1	0	0
GDP per capita	-/+	0	1	0
Agril. Expenditure (as % GDP)	-/+	1	0	0

Source: See text.

Table 7.5

The result of corerlation analysis between regressand and regressors

MORTALITY RATE AS REGRESSAND

RESULTS OF ANALYSIS

	SIGN	Significant Effect (.7 - 1)	Moderate Effect (.45 - .69)	Low Effect (.45)
Urbanisation	-	1	0	0
Primary school pupils	-	0	1	0
Edn. Recurrent Expenditure	-	0	1	0
Edn. Capital Expenditure	-	0	0	1
Health Recurrent Expenditure	-	0	1	0
Health Capital Expenditure	-	0	0	1
Physicians per 10,000	-	1	0	0
Nurses per 1,000	-	1	0	0
Hospital beds per 1,000	+	0	0	1
GDP per capita	-	0	1	0
Agril. Expenditure (as % GDP)	-	0	1	0

Source: See text.

Table 7.6

The results of correlation analysis between regressand and regressors

LIFE EXPECTANCY AT BIRTH AS REGRESSAND

RESULT OF ANALYSIS

	SIGN	Significant Effect (.7 - 1)	Moderate Effect (.45 - .69)	Low Effect (.45)
Urbanisation	+	1	0	0
Primary school pupils	+	0	1	0
Edn. Recurrent Expenditure	+	0	1	0
Edn. Capital Expenditure	+	0	0	1
Health Recurrent Expenditure	+	0	1	0
Health Capital Expenditure	+	0	0	1
Physicians per 10,000	+	1	0	0
Nurses per 1,000	+	1	0	0
Hospital beds per 1,000	-	0	0	1
GDP per capita	+	0	1	0
Agril. Expenditure (as % GDP)	+	0	1	0

Source: See text.

comparing apriori expectations with the result of analysis focussing on the simple correlation coefficients between each regressor and the regressand. In the table "0" denotes "No" and "1" means "Yes".

The question to be posed then is that, in areas of considerable mismatch between expectations and results, could the interrrelationships among the regressors be influencing the results? In attempting to answer this question, it would be necessary to

- (a) analyse, at each stage of regression, the interrelationships between the regressand and the prospective (but "abnormal") regressor while controlling for those regressors already in the model; and

- (b) study the selction procedures from which the present model has been derived.

7.4.2 Analysis of Pivoting Elements in the Regression Procedure

In analysing the pivoting elements during the regression procedure, two pieces of information have to be centred upon. One is the normalised regression coefficients which is the value that the prospective regressors would have if they were brought into the equation on the next step one at a time. The significance of this is measured by the f-statistic. If 'f' is too small, there is little reason to introduce the regressor concerned into the model at the next step.

The other is the "tolerance" which indicates whether the particular regressor is nearly a linear combination of variables already in the equation (in which case the tolerance would be small or equal to zero) or it would be introducing a new dimension to the prediction equation (in which case the tolerance would be large but still less than one as it should normally be).

The product of the normalised regression coefficients and the tolerance represents the amount of additional variance explained by introducing the particular regressor into the model.

7.4.3 Step-wise Analysis of Interrelationships

The following tables are illustrations of behavioural changes observed in the regressors (in relation to the regressand) when the pivoting elements are selected as explained in Section 7.4.2.

In the stepwise analysis of interrationships presented in the tables below, 'abnormal' regressand-regressor case is taken as that in which the sign of the multiple -R has become opposite to the sign of the simple -r for the variable concerned.

Table 7.7

Step-wise analysis of interrelationships
MORTALITY RATE AS REGRESSAND

Step	Variable Entered	"Abnormal" regressand - regressor case Not yet in Model	 Already in Model
01	Physicians/10,000	Health Recurrent Exp.	None
02	Urbanisation	None	None
03	Hospital beds/1,000	None	None
04	Agricul. Exp.	Edu. Recur. Exp. Edu. Capital Exp. Health Recurr. Exp. Health Capital Exp. GDP per capita	Physicians/10,000
05	Primary school pupils	Edn. Recur. Exp. Edn. Cap. Exp. Health Recur. Exp. Health Cap. Exp. Nurses/1,000 GDP per capita	Physicians/10,000
06	Health . Cap. Exp.	Edu. Cap. Exp. Health Recurr. Exp. GDP per capita	Health Cap. Exp. Physicians/10,000 Physicians/10,000
07	Educ. Cap. Exp	None	Edu. Cap. Exp. Health Cap. Exp. Physicians /10,000
08	Nurses/1,000	None	Educ. Cap. Exp. Health Cap. Exp. Physicians /10,000
09	Educ. Recur. Exp.	Health Recur. Exp.	Edu. Cap. Exp. Health Cap. Exp. Physicians /10,000
10	Health Recur. Exp.	GDP per capita	Edu. Cap. Exp. Health Recur. Exp. Health Cap. Exp. Physicians / 10,000

Source: See text

Table 7.8

Step-wise analysis of interrelationships
LIFE EXPECTANCY AT BIRTH AS REGRESSAND

Step	Variable Entered	"Abnormal" regressand - regressor case: Not yet in Model	Already in Model
01	Physicians/10,000	None	None
02	Primary school pupils	Edu. Recur. Exp. Edu. Cap. Exp. Health Recur. Exp. Health Cap. Exp. GDP per capita	None
03	Urbanisation	Edu. Recur. Exp. Edu. Cap. Exp Health Recur. Exp. Health Cap. Exp. GDP per capita Agric. Exp.	None
04	Hospital beds/1,000	Health Cap. Exp.	None
05	Agric. Exp.	Edu. Recur. Exp. Edu.Cap. Exp. Health Recur. Exp. Health Cap. Exp. Nurses/1,000 GDP per capita	Physicians/10,000
06	Edu. Cap. Exp.	Health Cap. Exp.	Edu. Cap. Exp. Physicians/10,000
07	Edu. Recur. Exp.	Health Recur. Exp. Health Cap. Exp.	Educ. Cap. Exp. Physicians/10,000
08	Health Recur. Exp.	Health Cap. Exp. GDP per capita	Edu. Cap. Exp. Health Recur. Exp. Physicians/10,000
09	Nurses/1,000	Health Cap. Exp. GDP per capita	Edu. Cap. Exp. Health Recur. Exp. Physicians/10,000
10	GDP per capita	Health Cap. Exp. Health Recur. Exp.	Educ. Cap. Exp. Health Recur. Exp. Physicians/10,000 GDP per capita

Source: See text

7.5 SUMMARY

The health models have by now been brought to a stage where any additional variable to be explained would only yield a comparatively negligible marginal benefit. From the analysis done so far, the following connective summary can be made.

When the regressand is mortality rate, the variables worth special mention are capital expenditures on education, recurrent expenditures on health, capital expenditures on health and number of physicians per 10,000 of people. For the second and fourth of these variables, it would appear that G.D.P per capita (which is the only variable uncontrolled for throughout the regression) exercises some spurious effects on the regressand-regressor relationship. Indeed in the partial correlation analysis[1] output (Appendix A-7), it can bee seen that when GDP is controlled for, these two variable exhibit "normal" behaviour eventhough with a low coefficient in the case of recurrent expenditures on health. "Normal" behaviour can be seen for capital expenditures on health when urbanisation is controlled for. However, in the case of capital expenditures on education, a "normal" behaviour (albeit low) can be observed only when urbanisation is controlled for.

When the regressand is life expectancy at birth, the variables worth special mention are capital expenditures on education, recurrent expenditures on health, number of physicians per 10,000 of people and G.D.P per capita. For these variables, capital expenditures on health (which is the only variable uncontrolled for) exercises similar spurious effects on the regressand-regressor relationship.

For either of the regressands in the analysis, it would seem that urbanisation and/or especially GDP tend to exert spurious effects on many of the regressors (especially on capital expenditures on health and education).

This would imply that in LDCs, capital expenditure on health (and especially education) both tend to compete with other resources (for example, agriculture) the application of which would considerably reduce the mortality rate or improve life expectancy at birth.

7.6 FOOTNOTES TO CHAPTER SEVEN

1. Partial correlation provides the researcher with a single measure of association describing the relationship between two variables while adjusting for the effects of one or more additional variables. (For more detailed description see Appendix A-7)

7.7 REFERENCES

1. Lindley, D.V. (1968) "The choice of variables in multiple regression" Journal of the Royal Statistical Society, Ser. B, 1968, pp.31-66.

CHAPTER EIGHT: CONCLUSIONS

8.1 INTRODUCTION

At the end of each of the previous chapters, a short connective summary has been given highlighting the direction of study as well as a comparative analysis of data and hypothesis. In this chapter, however, the conclusion of the study is presented. This is mainly to reiterate the way in which the data has been organised and also the way in which the findings from the analysis should be interpreted. The conclusion therefore involves further elaboration of the systems analysis aspect of the study and how this relates to the perception of health system in general. In this sense, theory is linked with data presenting several factors considered most relevant to health status in less-developed countries. Areas that might need to be further developed are suggested for future research work.

The tasks of this study have been:

1) To develop a framework for cross-national studies of health problems - this task has been fulfilled by presenting the health system model and its four level of recursions.

2) To analyse the relationships between mortality rate (as well as life expectancy at birth) and those variables identified as major determinants of health status in African developing nations. These variables have not just been selected based on previous studies and the relaibility of source-data, but they have also been tested as to their statistical significance. Thus the analysis done has not just been descriptive, but has also included Pearson-correlation analysis.

3) To develop a mathematical model in which the future value of the two dependent variables (mortality rate and life expectancy at birth) might be predicted. This model has been developed in the second stage of analysis which was based on multiple regression procedures.

8.2 FRAMEWORK FOR CROSS-NATIONAL STUDIES OF HEALTH PROBLEMS

As it has been mentioned earlier (chapter three), one of the purposes of the theoretical part of the study was to employ a framework to assist researchers in investigative studies into social sciences and in particular into health field.

To do so, we have tried to build up a theoretical model asserting that health system is an open system, a model is a way in which the human thought process can be amplified. Therefore, the proposed model is built up on the basis of system thinking. That is, the problems encountered in health systems are approached in this study by using systems approach not only to build up the theoretical model, but also cover the whole stages of the study.

The idea of system approach is a development of the use of system thinking where a series of steps or guidelines are followed which assist the conceptualisation of things as systems and in identifying their properties and behaviour.

The model allowed the selection of different variables from different parts of the health system.

The framework for cross-national studies of health problems is presented in the form of a MODEL, which having been constructed on the basis of system theory is a SYSTEM by itself. Its four subsystems and boundaries are identified as the four level of recursion. (See Chapter three).

The model is a multi-goal seeking system as such it can pursue different goals which may or may not have a common property, and, furthermore,it determines the goal to be pursued. It can produce the same outcome in different ways under changing or stable conditions.

With the above mentioned characteristics prevalent, the system is a purposeful system, having the will to select the ends as well as the means.

With the model being purposeful, we would expect to see the mode of the system to be "proactive", because this is the criteria which differentiate between purposeful system and purposive system. The expectation is fulfilled, since in applying the model the user has access to the means to be proactive. For example, if the model is used to investigate the possible investment in the health field by agencies (including government) it has, different factors under its employment such as, number of physicians, number of nurses, etc., to prevent the policy makers to decide hastily and spend the capital in places which follows the fashion rather than logic. To be clear, if the fashion is to build hospital and health centres, the policy makers are alerted by the model to consider the manpower to serve the hospitals before starting to built them.

8.3 THE RELATIONSHIP BETWEEN INDICATORS OF LEVEL OF HEALTH AND OTHER INDICATORS OF HEALTH MATRIX

Health status is not only a dependent variable we attempted to explain, but is an independent variable that affect other social factors. We have assumed that health status of nations (indicated by mortality rate and the life expectancy at birth) is dependent on the socioeconomic, demographic, and health services facilities. The following is the result of our correlation coefficients analysis, concluded after being compared with our expectations.

We expected to see a significant correlation between the dependent variables, indicating the level of health (mortality rate, and the life expectancy at birth) and those variables indicating the health services facilities (the number of physicians per 10,000 of population, the number of nurses per 1,000 of population, and the number of hospital beds per 1.000 of population). This, proved to be correct in the case of the number of nurses and not others. Therefore as general conclusion we can suggest that in African developing countries, number of nurses is more related to the health of the nations than the number of physicians per 10,000 and the number of hospital beds per 1,000 of population.

Health expenditures, as we hypothesised then, should have had a negative and strong relationship with mortality rate and a positive and significant relation with the life expectancy at birth, that proved to be correct for the recurrent expenditures, but for the capital expenditures some individual countries did not show the expected sign. However, the aggregate data was shown to have the same sign as we expected them to have.

Individual countries did not all show the same sign when the indicators of level of health were correlated with the urbanisation and the number of primary students per percentage of population. Yet again, the aggregate data was shown to fulfil the expectation.

Due to the uneven contribution of wealth in the third world countries, and the unrepresentativeness of G.D.P. per capita, we expected to see at least a moderate and negative relation between mortality rate and gross domestic product per capita and a positive and moderate relation between the life expectancy at birth and gorss domestic product per capita. We witnessed a negative and significance relation between mortality rate and G.D.P per capita for five of the countries involved in the study. However, the result of aggregate data suggests that there is a negative relation between these two variables.

The result of analysis for the life expectancy at birth and G.D.P. per capita for individual countries, is shown to be positive although the magnitude varies from country to country. The result of aggregate data backs up the general conclusion that, there is a positive correlation between G.D.P. per capita and the life expectancy at birth.

We are in liberty to assume that agriculture plays a major role in the life of the developing countries population. The whole existance of the inhabitants of these nations (with a few exceptions) depends on what they can plant, harvest, and eat. Any direct government contribution towards agriculture would obviously effect the being of these people. Having in mind this fact, we would expect to see a significant and negative relationship between expenditure on agriculture and mortality rate, and a positive and strong correlation between this variable and the life expectancy at birth.

When regressing the life expectancy at birth and expenditures on agriculture, the result of the analysis showed that our expectation was justified when considering the sign, but the sizes (magnitude) of coefficients were somehow mixed. The only country which lived up to our expection was Nigeria, Mauritus ignored this assumption and showed a non significant, almost non-existance but positive correlation. The other four (Botswana, Kenya, Swaziland, and Republic of Tanzania) showed a moderate and positive signs. However, we can conclude that there is a positive correlation between the life expectancy at birth and the expenditures on agriculture.

When mortality rate was regressed against expenditures on agriculture five of the countries involved in the study showed the expected signs, in the absense of the uniformal results we could not possibly establish any conclusion for individual countries but by looking at the aggregate data we can tentatively conclude that this negative coefficients between the two variables exist.

We finally, concluded that there are highly significant interrelationships among the prime variables of our health matrix. Accordingly, the analysis of any particular one of these variables would, in all proabaility, be enhanced by consideration of the other variables.

8.4 "THE" HEALTH MODELS

The equations obtained for mortality rate and life expectancy at birth represent the HEALTH MODELS being propagated in this research for policy formulation in Less Developed Countries (LDCs) generally. It must be emphasised however that these models are eseentially for prediction purposes only and not for control purposes.

In explaining the models therefore, it is necessary to pose the following questions for each of the equations:

Does the equation as it stands make any sense? How meaningful are the signs and magnitude of the coefficients? How meaningful is the magnitude of the residual? What is the relevance of the variance explained? Who would be the end-users of the model and how useful would the model be to them as it stands?

The equations are:

$$MR = 23.177 - .438URB - .165PSP - .51REE + 0.168CEE + .66REH + .212CEH + 2.020PHY - .164NUR + 2.059BED - .001AGR$$

$$LEAB = 40.077 + .593URB + .154PSP + .297REE - .417CEE - .467REH - 1.825PHY + .274NUR - 3.231BED - .005GDP + .001AGR$$

With the following notation:

1. MR = Mortality Rate
2. LEAB = Life expectancy at birth
3. URB = Urbanisation
4. PSP = Primary School pupils
5. ERE = Education Recurrent Expenditures
6. ECE = Education Capital Expenditures
7. HRE = Health Recurrent Expenditures
8. HCE = Health Capital Expenditures
9. PHY = Phsysicians per 10,000 of population
10. NUR = Nurses per 1,000 of population
11. BED = Hospital Beds per 1,000 of population
12. GDP = Gross Domestic Product per capita
13. AGR = Agriculture expenditure

The MODELS have been extracted with careful consideration and the ultimate care has been taken to avoid any mismatch between the models themselves and the Aprioristic expectation of the study. That emphasize the validity of models and proves that they (MODELS) make sense as they stand.

By looking at the sign and magnitude of the coefficients we would realise that which of the variables move in the same direction and which ones do not. In certain areas where the certain correlation coefficients has different sign from those of multiple regression coefficients, we would conclude that there are some problems in the data. It is evident by the large magnitude of the standard error.

Magnitude of the residual is only meaningful when we are looking at aggregate values of dependent variable(s) (regressand, for all the countries) as long as the model is not for control purposes, we can only speculate about the specific value of any particular country based on the magnitude of the coefficients of regressors (independent variables).

The relevance of the variance explained is very high for mortality rate and life expectancy at birth, the regressand explained by the selected regressors are 96.38 percent and 97.69 percent respectively.

Two interesting groups of people would be the end users of the models, a) policy makers, b) academics. The first group can use the models to set goals and pursue their activities to achieve the set goals. The academics who are interested in strategic planning as basis for policy formulation in health might be the second group to be interested in the models.

The first group is interested in sociopolitical aspect of any decision which is made, the second one might be interested in the socio economic aspect of any research to be investigated. Therefore there would be constant correction from both ends when their interest overlaps each other.

8.5 CHARACTERISTICS OF LESS DEVELOPED COUNTRIES

Data compiled for the analysis showed that, despite the great effort by governments and international organisations, the basic needs for vast number of the people of the countries involved in our study remain unsatisfied. Geographical maldistribution of health care resources is found to be with an extreme degree in these countries. Fund raised from some sources may only be available for spending on particular groups of the population whose health needs may be substantially less than those of the other sections of the population. It is apparent that those who raise funds, expect to control the way in which the fund is spent, and consequently may spend it where the needs are not as much as some other areas. Separate origins of funds result in separate programmes of health services.

Variations among income groups in the use of services, which have been reduced in many industrialised countries, remain sharp in most developing countrties. Together with this is the limited availability of services to rural, compared with urban populations.

In most of the countries involved in the study, very much over half of the national budget is spent on health care in urban areas, the home of no more than a fifth of the total population.

Long sections of the rural population have no practicable access to organised services at all.

Inhabitants of shanty towns and slums in big cities, although geographically close to health services, often have limited access to them for economic reasons and also lack proper sanitation and potable water.

There may also be health inequities maong racial and ethnic groups in a country, often associated with differentials in the economic strength and social position of those groups, historical, political, and economic developments lie at the back of these many forms of inequity in the financial support provided for health activities.

The data analysed for the study also have shown that the following chracteristics remain true of many less developed countries:

1) Proportionate concentration of expenditures on health services in urban areas compared with expenditures on rural areas.

2) Heavy concentration of expenditures on secondary and tertiary care services compared with expenditure on primary care services.

3) Heavy concentration of expenditures on curative services compared with expenditures on preventive services.

8.6 FUTURE WORK

The given models have shown that the magnitude of standard error in large; as has been explained earlier (section 8.4), this largeness is due to in-built error of data (UN, or any other official data). That means one of the possible objectives of future research might be to minimise these error in the data. If one is successful in minimising the errors, one might then be interested in developing a model to use for both prediction and control.

As adequate health and health care have come to be more and more regarded as fundamental and universal human rights, the population's demand for improved care has taken the form of political pressure for improved health systems in nearly all of the world's 150 or so nation-states. It is within the nation-state that political-economic forces fashion national budgets, including funds for health manpower, facilities, and services. Thus, while it remains important to study cross-cultural variation in orientations towards illness and ways of dealing with it (also, many such variations can be identified within most countries), an overriding importance must be given to the political economy of the nation-state in determining the nature of health services. Consequently a micro-within kind of study concentrating on behaviour of health systems according to the political economy of the country involved in the study could be interesting.

Therefore, the possible areas for research would be explained as a) correction of data, b) explanation of judgmental issues such as cultural orientation and political influences.

If the first area of research is tackled, we arrive at a model to use for both control and prediction. In testing the model we may find that the two objectives are incompatible and so it may be necessary to have one model for prediction and another for control. On the issue of control, it is still uncertain whether it should be more effective to use deterministic models ch as linear programming or goal programming, etc., or to use heuristic models. It may well be that the balance of these two will be required, for example, chance constraints goal programming is an area that may be appropriate.

APPENDICES

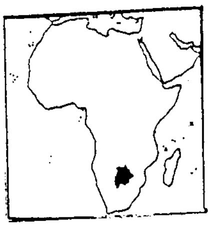
LIST OF APPENDICES

APPENDIX A-1

DEMOGRAPHIC AND SOCIOECONOMIC
CONDITIONS OF THE COUNTRIES
INVOLVED IN THE STUDY

Botswana

Republic of Botswana



Location South central Africa
Zimbabwe and Zambia are to the north-east, South Africa to the south, and south-west Africa to the west and north. A large part forms the Kalahari Desert. Land-locked.

Land Area 600 372 km^2 = 231 805 mi^2

Climate Sub-tropical
Weather at Francistown, 1 004 m altitude
Temperature: hottest months Dec, Jan 18-31°C, coldest June 5-23°C, Rainfall (av monthly), driest months July, Aug 1 mm, wettest Jan 107 mm.

Time 2 hours ahead of GMT

Measures Metric system, which replaced the UK (imperial) system from December 1, 1974

Monetary unit Pula (Pu) = 100 thebe; the pula replaced the South African rand at par from August 23, 1976
Rate of exchange (1979 av): free Pu 0.815 = $ 1 ($ 1.228 = 1 Pu).
Pu 1.728 = £1

Summary

Political Republic, which became independent on September 30, 1966; formerly a UK protectorate and known as Bechuanaland. Member of UN, OAU, Commonwealth and an EEC ACP state.

Economic Mainly an agricultural economy based on cattle, but with a rapidly growing mining industry (especially for diamonds). About one-third of the non-agricultural labour force works in South African mines

People, resources and equipment

Population 1960 505 000 , 1970 579 000 , 1979 791 000
Growth: 1960-70 1.4 %pa, 1970-79 3.5 %pa
Density (1979): 1 person per km^2
Vital statistics (rate per 1 000 people, 1970-75): births 51 , deaths 19

Cities (population in 000, 1976)

Gaborone (capital)	37	Kanye	39	Francistown	25
Serowe	43	Molepolole	32	Selebi-Pikwe	23

Race (1971) African 99 % (Bamangwato 34%, Bangwaketse 11%), European 1 %

Language Tswana and English; also various Tswana dialects

Religion (1970) Christian 60 %, Animist 40 %

Education (1978) Pupils 165 198, teachers 5 864

Labour force (1979) 376 000 ; in agriculture 304 000 (81 %)
Working in South African mines (1978) 23 195

Personnel Scientists and engineers (1972): 786
Physicians (1975): 72, 1 per 9 583 people

continued...

Standard of living
National income per person (1979): Pu 730 = $ 870 = £ 420
Production per person (1978): electricity 560 kW h
Newspapers (1977): number 2; circulation 17 000, 24 per 1 000 people
Telephones (Dec 1975): 8 000, 12 per 1 000 people

Livestock (000, 1979) Cattle 3 300 , sheep 450 , goats 1 200

Mineral reserves Coal (1977) 3 500 mn tonnes, uranium (1979) 400 tonnes

Electrical capacity (1977) 92 megawatts

Hospital beds (1976) 2 137, 1 per 323 people

Roads (1979) 10 476 km = 6 509 mi, density 0.02 km per km^2

Railways (1979) 710 km = 441 mi, density 0.001 km per km^2

Airports Gaborone, Francistown, Selebi-Pikwe, Maun, Orapa

Durable equipment (at end-year)	000	no per 1 000 people	no per km of road
Radio sets (1977)	63	88	
Passenger cars (1979)	5.7	7.0	0.5
Commercial vehicles (1979)	14.8	18	1.4

Production, finance and trade

Gross domestic product
1977/78 (year ending June 30th): Pu 333.2 mn = $ 401 mn = £ 219 mn
1979 est: Pu 450 mn = $ 550 mn = £ 260 mn

Agricultural production index (1975 = 100) 1960 81, 1970 90, 1979 110
Growth: 1960-70 1.1%pa, 1970-72 2.1%pa

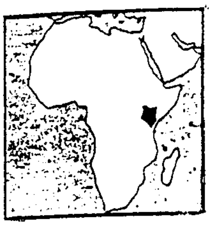
Main products (1979) Agriculture (000 t) Sorghum 13 , maize 8 , millet 1 , groundnuts 7 , milk 88 , beef and veal 44 , hides and skins 5.2 , timber (000 m , 1978) 780
Other (1978) Electricity 408 mn kW h, coal 315 000 t, nicket ore (metal content, 1977) 12 099 t, diamonds (1977) 2.66 mn metric carats, beer (1977) 481 000 hl

Transport traffic (1979) Rail Cargo 1 488 mn tonne-kilometres

continued...

Kenya

Republic of Kenya



Location East central Africa
With a coastline on the Indian Ocean. Somalia is to the north-east. Ethiopia and Sudan to the north. Uganda to the west and Tanzania to the south.

Land Area 582 646 km^2 = 224 961 mi^2 of which, 3 831 km^2 for Lake Victoria, 6 405 km^2 for Lake Turkana (formerly Rudolf)

Climate Tropical, hot and humid on the coast, temperate inland, dry to the north
Weather at Nairobi, 1 820 m altitude
Temperature: hottest month Feb 13-25^oC, coldest July 11-21^oC
Rainfall (av monthly): driest month July 15 mm, wettest April 211 mm

Time 3 Hours ahead of GMT

Measures Metric system, introduced from 1969 to replace the UK (imperial) system

Monetary unit Kenya shilling (K Sh) = 100 cents: also used is Kenya pount (K £) = 20 K Sh. The decimal currency was introduced September 14, 1966 to replace the East African pound (EA £) at K Sh 20 = EA £ 1
Rate of exchange (1979 av): par K Sh 9.66 = SDR 1,
free K Sh 7.477 = $ 1,K Sh 15.86 = £ 1

Summary

Political One-party republic, which became independent December 12, 1963; formerly the UK colony and protectorate of Kenya. Member of UN, OAU, Commonwealth and an EEC ACP state. Member formerly of the East African Community during its existence from 1967 to 1977

Economic Mainly an agricultural economy, with an expanding industrial sector. Agricultural exports are mainly coffee and tea. Hydro-electric capacity is being increased and tourism is becoming important. Industry includes especially oil refining; petroleum products have become the second most important export, using imported oil.

People, resources and equipment

Population 1960 8.12 mn. 1970 11.23 mn. 1979 15.32 mn
Growth: 1960-70 3.3 %pa. 1970-79 3.5 %pa
Density (1979): 26 people per km^2
Vital statistics (rate per 1 000 people, 1970-75): births 50 , deaths 14

Regions (population in 000, 1979; total of 15.33mn)

Nairobi	835	Coast	1 339	Nyanza	2 634
Provinces		Eastern	2 717	Rift Valley	3 240
Central	2 348	North Eastern	373	Western	1 836

continued...

Cities (population in 000, 1979)

Nairobi (capital)	835	Kisumu	150	Meru	73
Mombasa	342	Nakuru	93	Eldoret	50

Race (1969) African 98%. Asian 1 1/4%. European 1/3%. Arab 1/4%; of African: Kikuyu 20%, Luo 14%, Luhya 13%, Kamba 11%, Gusii 6%

Language Swahili and English (official); Kikuyu, Luo and other languages are also used

Religion (1979) Christian 50 %, Animist 35 %, Moslem 6 %

Education (1977) Pupils 3 309 400, teachers 104 033

Labour force (1979) 5 998 000 ; in agriculture 4 682 000 (78 %)

Personnel Scientists and engineers (1975): 5 130
Physicians (1978): 1 270, 1 per 11 700 people

Standard of living
National income per person (1979): K Sh 2 850 = $ 381 = £ 180
Consumption per person (1977): energy (1976) 152 kg coal equivalent, electricity (production) 78 kW h, newsprint 0.3 kg, steel 15 kg
Newspapers (1976): number 3; ciruculation 154 000, 11 per 1 000 people
Telephones (Dec 1978): 156 000, 10 per 1 000 people

Livestock (000 1979) Cattle 10 470 , sheep 4 000 , goats 4 500 , pigs 65 , camels 550 , chickens 17 500

Petroleum refinery capacity (1977) 4.75 mn tonnes

Electrical capacity (1977) 356 megawatts, of which, hydro 173 megawatts

Hospital beds (1976) 17 896, 1 per 773 people

Roads (1979) 51 368 km = 31 919 mi, density 0.09 km per km^2

Railways (1978) 2 038 km = 1 266 mi, density 0.003 km per km^2

Ships (registered. 1980) 19, total of 17 371 gross tons

Port (goods traffic, 000 tonnes, 1978)
Mombasa: loaded 1 800, unloaded 4 266

Airports (1978) Passenger departures and arrivals: Nairobi 867 000. Mombasa 309 000; also Kisumu and (1980) 8 other airports with scheduled flights

Durable equipment (at end-year)	000	no per 1 000 people	no per km of road
Radio sets (1977)	525	36	
Television sets (1977)	60	4.1	
Passenger cars (1978)	122	8.1	2.4
Commercial vehicles (1978)	97	6.4	1.9

continued...

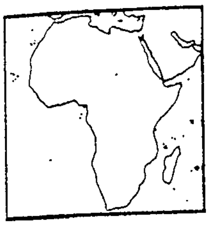
Production

Gross domestic product 1979: K Sh 45 167 mn = $ 6 041 mn = £ 2 848 mn
Growth in real terms: 1964-70 6.0%pa. 1970-79 6.5%pa

Structure of gross domestic product By origin (1978) Agriculture 31%, manufacturing 12%, construction 4%, other 53%
By type (1979) Final consumption expenditure 84% (of which, government 20%), stock investment -1%, gross fixed capital formation 23%, exports of goods and services 26%, less imports of goods and services -33%

continued...

Mauritius



Location Western Indian Ocean
A group of islands, the main one of which, the island of Mauritius, lies 900 km east of the island of Madagascar; the other main islands are Rodrigues, Agalega and St Brandon

Land Area 2 045 km^2 = 790 mi^2
of which, island of Mauritius 1 865 km^2, Rodrigues 109 km^2

Climate Sub-tropical
Weather at Mauritius, 55 m altitude
Temperature: hottest month January 23-30^{o}C, coldest July, Aug 17-24^{o}C
Rainfall (av monthly): driest month Sept 36 mm, wettest March 221 mm

Time 4 hours ahead of GMT

Measures Metric system: also length 12 lignes = 1 pouce, 12 pouces = 1 pied = 0.32484 metre = 1.066 feet
area 40 000 $pied^2$ = 1 arpent = 0.422 hectare = 1.043 acres

Monetary unit Mauritius rupee (M R) = 100 cents
Rate of exchange (1979 av): par M Rs 8.271 = SDR 1
(M Rs 10 = SDR 1 from October 1979)
free M Rs 6.402 = $1, M Rs 13.58 = £1

Summary

Political Parliamentary monarchy, which became independent March 12, 1968; formerly a UK colony (before 1810 a French colony). Member of UN, OAU, Ocam, Commonwealth and EEC ACP state.

Economic Sugar is the main export product; although Mauritius is an agricultural economy, cereals and other food are large imports and crop diversification is under way. Industry is being developed, notably in textiles and electronic components; tourism is of increasing importance. There is a special Export Processing Zone (MEPZ).

People, resources and equipment

Population 1960 657 000, 1970 829 000, 1979 942 000
Growth: 1960-70 2.4%pa, 1970-79 1.5 %pa
Density (1979): 461 people per km^2
Vital statistics (rate per 1 000 people, islands of Mauritius and Rodrigues only, 1979): births 27.8, deaths 7.3

Regions (population in 000, 1978) Mauritius island 896, Rodrigues 28, Agalega and St Brandon 0.4

Cities (population in 000, 1978) Port Louis (capital) 143, Beau Bassin-Rose Hill 84, Curepipe 54, Quatre Bornes 54, Vacoas-Phoenex 52

continued...

Race (1979) Indo-Mauritian 69%, European, African and mixed 28%

Language English and French; Creole is also used
Mother tongue (1972): Hindi 39%, Creole 33%, Urdu 9%, Tamil 7%, French 4%, Telegu 3%, Chinese 2%

Religion (1979) Hindu 53%, Roman Catholic 25 %, Moslem 16%

Education Pupils (1978) 216 135 , teachers (1977) 8 750

Labour force (1979) 345 000 ; in agriculture 99 000 (29 %)

Personnel Scientists and engineers engaged in research (1977): 151
Physicians (1977): 376, 1 per 2 418 people

Standard of living
National income per person (1979): M Rs 6 800 = $ 1 060 = £ 500
Consumption per person: energy (1976) 405 kg coal equivalent, electricity (1978) 450 kW h, newsprint (1977) 1.1 kg
Newspapers (1977): number 10; circulation 85 000, 94 per 1 000 people
Telephones (Dec 1978): 34 400, 37 per 1 000 people

Livestock (000, 1979) Cattle 56 , goats 70 , chickens 1 400

Electrical capacity (1977) 150 megawatts

Hospital beds (1977) 3 218, 1 per 282 people

Roads (1979) 1 775 km = 1 103 mi, density 0.87 km per km^2

Ships (registered, 1980) 18, total of 37 675 gross tons

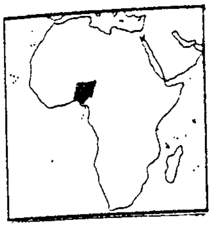
Port (goods traffic, 000 tonnes, 1978) Port Louis: loaded 760, unloaded 1 063

Airports Plaisance, Rodrigues, Plaines de Roches (planned)

Durable equipment (at end-year)	000	no per 1 000 people	no per km of road
Radio sets (1976)	200	223	
Television sets (1979)	41	46	
Passenger cars (1979)	26	27	14.6
Commercial vehicles (1979)	14	15	7.9

continued...

Nigeria
Federal Republic of Nigeria



Location West Africa
With a south-facing coastline on the Atlantic Ocean in the Gulf of Guinea. Benin is to the west. Niger to the north and Chad and Cameroon to the east.

Land Area 923 768 km^2 = 356 669 mi^2

Climate Tropical
Weather at Lagos, 3 m altitude
Temperature: hottest month March 26-32^o, coldest August 23-28^{o}C
Rainfall (av monthly): driest month Dec 25 mm, wettest June 460 mm

Time 1 hour ahead of GMT

Measures Metric system, which replaced the UK (imperial) system from January 1, 1973; also: 1 mudu (of rice) = 1.13 kilograms = 2.5 pounds, 1 tiya (of rice) = 2.27 kilograms = 5 pounds, 2 mudu = 1 tiya
1 load (of cocoa) = 27.22 kilograms = 60 pounds

Monetary unit Naira (₦) = 100 kobo; the naira was introduced as a decimal currency on January 1, 1973 to replace the Nigerian pound (N £) at the rate
₦ 2 = N £ 1
Rate of exchange (1979 av): free ₦ 0.6027 = $ 1 ($ 1.659 = ₦ 1).
₦ 1.279 = £ 1

Summary

Political Republic, which became independent October 1, 1960; fromerly the UK colony and protectorate of Nigeria. In 1961 the northern part of the UK Cameroons joined Nigeria, the southern portion becoming part of Cameroon. From 1967 to 1970 there was an attempt by the Eastern States to break away and form a new state of Biafra; the attempt was unsuccessful. Member of UN, OAU, Opec, Ecowas, Commonwealth and an EEC ACP state.

Economic Oil has become the most important feature of the economy replacing agricultural produce as the main export. Agriculture remains important for the local economy. Manufacturing industry is developing rapidly, and new projects include petro-chemicals, fertilisers, motor vehicles and cement

People, resources and equipment

Population 1960 42.95 mn. 1970 56.35 mn. 1979 74.60 mn
a UN estimates; official Nigerian estimates indicate a higher population; for 1979, 82.64 mn
Growth: 1960-70 2.8 %pa. 1970-79 3.2 %pa
Density (1979): 81 people per km^2
Vital statistics (rate per 1 000 people, 1970-75): births 50 , deaths 20

continued...

Regions (States, as revised 1976; population in 000, February 1976)

Anambra	2 469	Imo	5 000	Ondo	2 728
Bauchi	3 240	Kaduna	4 098	Oyo	5 209
Bendel	3 536	Kano	5 775	Plateau	1 421
Benue	2 641	Kwara	2 399	Rivers	1 544
Borno	2 991	Lagos	1 100	Sokoto	2 873
Cross River	4 626	Niger	2 900		
Gongola	1 585	Ogun	1 449		

Cities (population in 000, 1975)

Lagos (capital a)	1 477b	Ilesha	224	Aba	177
Ibadan	847	Onitsha	220	Ife	176
Ogbomosho	432	Iwo	214	Ila	155
Kano	399	Ado Ekiti	213	Oyo	152
Oshogbo	282	Kaduna	202	Ikerre Ekiti	145
Ilorin	282	Mushin	197	Benin City	136
Abeokuta	253	Maiduguri	189	Iseyin	115b
Port Harcourt	242	Enugu	187	Katsina	109b
Zaria	224	Ede	182	Calabar	103

a There are plans to move the capital to a site near to Abuja in a new Federal Capital Territory by 1991 b 1971

Race (1979) African 99.9 % (in 1961: Hausa 21%, Ibo 18%, Yoruba 18%, Fulani 10%, Tiu 6%, Kanuri 5%, Ibibio 5%)

Language English (official); also Hausa, Ibo, Yoruba and other local languages

Education (1973/74) Pupils: primary 4 889 857, secondary 498 744, vocational 20 423, teacher-training 49 136, higher (1975/76) 32 971. Teachers: primary 144 351, secondary 19 409, vocational 1 120, teacher-training 2 360, higher (1975/76) 5 019

Labour force (1979) 28 337 000 ; in agriculture 15 354 000 (54 %)

Personnel Scientists and engineers (1970/71); 19 885
Physicians (1976); 4 876, 1 per 13 897 people

Standard of living
National income per person (1979) ₦ 370 = $ 610 = £ 290
Consumption per person (1977): energy (1976) 94 kg coal equivalent, electricity (production, 1979) 70 kW h, newsprint 0.4 kg, steel 27 kg
Newspapers: number (1976) 19, circulation (1974) 660 000, 11 per 1 000 people
Telephones (March 1979): 135 900, 1.8 per 1 000 people

Livestock (000, 1979) Cattle 12 000 , sheep 8 500 , goats 24 500 , pigs 1 100 , horses 250 , asses 700 , camels 17 , chickens 110 000

Mineral reserves Lignite (1979) 169 mn tonnes
Crude oil (1978) 2 500 mn tonnes
Natural gas (1978) 1 200 bn cubic metres

continued...

<u>Petroleum refinery capacity</u> (1977) 3.0 mn tonnes

<u>Electrical capacity</u> (1977) 960 megawatts

<u>Hospital beds</u> (1975) 53 889, 1 per 1 230 people

<u>Roads</u> (1977) 105 000 km = 65 000 mi, density 0.11 km per km^2

<u>Railways</u> (1975) 3 524 km = 2 19) mi, density 0.004 km per km^2

<u>Inland waterways</u> Niger river 20 000 km = 12 500 mi

<u>Ships</u> (registered, 1980) 116, total of 498 202 gross tons

<u>Ports</u> (goods traffic, 000 tonnes, 1971) Bonny (crude oil port) loaded 54 880. Burutu (crude oil port) loaded 13 348. Lagos (Apapa) loaded 1 048, unloaded 3 878. Also: Port Harcourt, Calabar, Koko, Sapele, Warri

<u>Airports</u> (1980) Murtala Muhammad (26 km from Lagos). Ibadan, Kano and 11 other airports with scheduled flights

<u>Durable equipment</u> (at end-year)	000	no per 1 000 people	no per km of road
Radio sets (1977)	5 250	74	
Television sets (1977)	450	6.3	
Passenger cars (1978)	404	5.5	3.8
Commercial vehicles (1978)	343	4.7	3.3

Production

<u>Gross domestic product</u> 1978/79 (year ending March 31st):
₦ 28 888 mn = $ 45 137 mn = £ 23 241 mn
1979 est: ₦ 29 500 mn = $ 49 000 mn = £ 23 000 mn
Growth in real terms: 1970-78 11.0%pa

<u>Structure of gross domestic product</u> (1977/78) By origin
Agriculture 23%, mining and quarrying 24%, manufacturing 5%, construction 9%, other 39%
By type Final consumption expenditure 76% (of which, government 13%) gross fixed capital formation 31%, exports of goods and services 26%, less imports of goods and services -33%

<u>Main exports</u> (% of total exports)

Crude oil
Cocoa
Palm nuts and oil
Groundnuts and oil
Rubber
Other

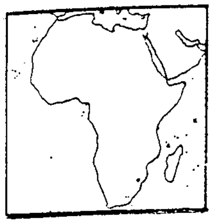
1960
1970
1978

0% . 20 . 40 . 60 . 80 . 100

continued...

Swaziland

Kingdom of Swaziland



Location South-east Africa
Mozambique is to the east and South Africa is on other borders. Land-locked

Land Area 17 365 km^2 = 6 705 mi^2

Climate Sub-tropical
Weather at Mbabane, 1 163 m altitude
Temperature: hottest months Jan, Feb 15-25^oC
coldest June 6-19^oC
Rainfall (av monthly): driest month June 20 mm, wettest Jan 354 mm

Time 2 hours ahead of GMT

Measures Metric system, which replaced the UK (imperial) system in general from 1974

Monetary unit Lilangeni (li) = 100 cents, lilangeni becoming emalangeni (Ei) for more than one; new currency introduced September 1974 to replace the South African rand at Li 1 = R 1
Rate of exchange (1979 av): par Li 1 = R 1.
free Li 0.842 = $ 1 ($ 1.188 = Li 1), Ei 1.786 = £ 1

Summary

Political Parliamentary monarchy, which became independent September 6, 1968; fromerly a UK protected state. Member of UN, OAU, Commonwealth and an EEC ACP state

Economic The main exports are agricultural products, especially sugar, citrus fruit and wood pulp, and mineral products, especially asbestos and iron ore. Livestock and products are important locally. Industry includes processing of agricultural produce, fertilisers and television set assembly.

People, resources and equipment

Population a 1960 320 000 , 1970 420 000 , 1979 543 000
a De jure population: includes absentees, mainly in South Africa (for 1976, 25 420 of a total de jure population of 519 960)
Growth: 1960-70 2.8 %pa, 1970-79 2.9 %pa
Density (1979): 31 people per km^2
Vital statistics (rate per 1 000 people, 1970-75): births 48 , deaths 21

Cities (population in 000, 1976) Mbabane (capital a) 22. Manzini 10
a Lobamba is to become the legislative capital

Race (1976) African 98% (Swazi 90 %), European 1½%

Language English and siSwati (Swazi)

Religion (1976) Christian 60 %, Animist 40 %

continued...

Education (1977) Pupils 118 200 , teachers 3 920

Labour force (1979) 247 000 ; in agriculture 182 000 (74 %)
Employed in South Africa (1974): 9 051

Personnel (1976) Physicians 54, 1 per 9 630 people

Standard of living
National income per person (1979): Ei 650 = $ 770 = £ 360
Consumption per person (1977): electricity 330 kW h
Newspapers (1976): number 1; circulation 5 000, 9.6 per 1 000 people
Telephones (Dec 1978): 9 900, 18 per 1 000 people

Livestock (000 1979) Cattle 650 , sheep 33 , goats 265 , pigs 22

Mineral reserves Coal (1961) 1 820 mn tonnes

Electrical capacity (1977) 70 megawatts

Hospital beds (1976) 1 717, 1 per 303 people

Roads (1977) 2 455 km = 1 524 mi, density 0.14 km per km^2

Railways (1979) 316 km = 196 mi, density 0.018 km per km^2

Airport Matsapa (Manzini)

Durable equipment (Dec 1977) Radio sets: 70 000, 131 per 1 000 people
Passenger cars: 8 200, 15 per 1 000 people, 3.3 per km of road
Commercial vehicles: 6 800, 13 per 1 000 people, 2.8 per km of road

Production, finance and trade

Gross domestic product
1976/77 (year ending June 30th): Ei 272 mn = $ 313 mn = £ 183 mn
1979 est: Ei 380 mn = $ 450 mn = £ 210 mn

Agricultural production index (1975 = 100) 1970 83, 1979 124;
growth 1970-79 4.6%pa

Main products (000 t, 1979) Agriculture Maize 55 , rice 5 ,
potatoes 6 , tomatoes 4 , sugar, raw value 255 , citrus fruit 80 ,
pineapples 20 , cotton 6 , milk 36 , beef and veal 14 .
timber (000 m^3, 1978) 2 572 Other (1977) Coal 129, electricity
(mn kW h) 173 , iron ore (Fe content) 9 15, asbestos 38, wood pulp 152

Transport traffic (1978) Air 5 mn passenger-km, cargo 0.1 mn t-km
Rail Mainly iron ore transported to Maputo in Mozambique

Tourism Number of visitors (1975) 115 000

Comsumer price index (1975 = 100) 1979 158.6; growth 1970-79 10.9%pa

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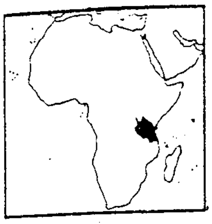
Tanzania

The United Republic of Tanzania



Location East central Africa
With a coastline on the Indian Ocean, Kenya and Uganda are to the north, Rwanda, Burundi and Zaire to the west, and Zambia, Malawi and Mozambique to the south. Territory includes the islands of Zanzibar and Pemba in the Indian Ocean about 40 km off the coast.

Land Area 942 000 km^2 = 363 710 mi^2
of which, mainland 939 360 km^2 = 362 690 mi^2, Zanzibar and Pemba 2 640 km^2 = 1 020 mi^2

Climate Topical on the coast, semi-temperate inland
Weather at Dar es Salaam, 14 m altitude
Temperature: hottest month Feb 25-31^{o}C, coldest July, Aug 19-28^{o}C
Fainfall (av monthly): driest month Aug 25 mm, wettest April 290 mm

Time 3 hours ahead of GMT

Measures Metric system, introduced from 1967 to replace the UK (imperial) system: also:
weight (mass) 36 ratili = 1 frasila = 36 pounds = 16.33 kilograms

Monetary unit Tanzanian shilling (T Sh) = 100 cents; also used is Tanzanian pound (T £) = 20 T Sh. The decimal currency was introduced June 14, 1966 to replace the East African pound (EA £) at T Sh 20 = EA £ 1
Rate of exchange (1979 av): free T Sh 8.250 = $ 1. T Sh 17.50 = £ 1

Summary

Political One-party republic, which became independent December 9, 1961; formerly, as Tanganyika, a UK trust territory. Zanzibar, formerly a UK protectorate, joined with Tanganyika on April 26, 1964, having become independent December 9, 1963. Member of UN, OAU, Commonwealth and an EEC ACP state. Member formerly of the East African Community during its existence from 1967 to 1977.

Economic Mainly an agricultural economy, with large exports of coffee, cotton, fruit and vegetables. There are some minerals, including diamonds, coal and iron ore. Refining of imported crude oil is important. Some manufacturing industry has been developed, especially brewing, textiles and cement.

People, resources and equipment

Population 1960 10.33 mn, 1970 13.27 mn, 1979 17.98 mn
Growth: 1960-70 2.5 %pa. 1970-79 3.4 %pa
Density (1979): 19 people per km^2
Vital statistics (rate per 1 000 people, 1967): births 47 , deaths 22

continued...

Regions (population in 000, 1979; total of 17.98 mn)
Tanganyika (mainland) 17 492. Zanzibar 490

Cities (population in 000, 1978) Dar es Salaam (capital a) 870, Mwanza 171, Tanga 144, Zanzibar 90, Arusha 88, Moshi 52.
a It is planned that the capital is to be moved to Dodoma

Race (1970) African 98% (of whom, Sukuma 12%, Makonde 4%)

Language Swahili and English; local languages are also used.

Religion (1979) Animist 35 %, Christian 30 %, Moslem 30 %

Education (1976/77) Pupils 2 027 275, teachers 42 554

Labour force (1979) 7 132 000 ; in agriculture 5 818 000 (82 %)

Personnel (1977) Physicians: 1 020 , 1 per 16 800 people

Standard of living
National income per person (1979): T Sh 2 008 = $ 243 = £ 115
Consumption per person (1977): energy (1976) 68 kg coal equivalent
electricity (production 1979) 42 k h, newsprint 0.1 kg, steel 5 kg
Newspapers (1977): number 2; ciruclation 133 000, 7.9 per 1 000 people
Telephones (Dec 1977): 74 300, 4.3 per 1 000 people

Livestock (000, 1979) Cattle 15 300 , goats 4 700 , sheep 3 000 , chickens 20 700 , ducks 2 450 .

Mineral reserves Coal (1979) 200 mn tonnes
Natural gas (1978) 1.4 bn cubic metres
Iron ore (1974) 90 mn tonnes

Petroleum refinery capacity (1977) 0.85 mn tonnes

Electrical capacity (1977) 180 megawatts

Hospital beds (1975) 26 000 , 1 per 610 people

Roads (1978) 33 222 km = 20 643 mi, density 0.04 km per km^2

Railways (1978) 3 682 km = 2 288 mi, density 0.004 km per km^2

Oil pipeline Dar es Salaam to Zambia 1 700 km = 1 060 mi

Inland waterways Lakes Tanganyika, Victoria and Malawi

Ships (registered 1980) 32, total of 55 916 gross tons

continued...

Ports (goods traffic, 000 tonnes, 1975)

	loaded	unloaded
Dar es Salaam	665	2 706
Tanga	159	193
Mtwara	16	67

Also Mwanza (on Lake Victoria), Kigoma (on Lake Tanganyika)

Airports Passenger departures and arrivals (000, 1976): Dar es Salaam 314 , Kilimanjaro (Arusha) 53 ; also (1980) 20 other airports with scheduled flights.

Durable equipment (at end-year)	000	no per 1 000 people	no per km of road
Radio sets (1977)	310	18	
Television sets (1977)	5.0	0.3	
Passenger cars (1978)	43	2.4	1.3
Commercial vehicles (1978)	49	2.8	1.5

Production

Gross domestic product 1979: T Sh 37 656 mn = $ 4 564 mn = £ 2 152 mn
Growth in real terms: 1970-79 5.3%pa

Structure of gross domestic product (1978) By origin Agriculture 48% manufacturing 8%, construction 2%, transport and communications 5%, other 37%.

APPENDIX A-2

QUESTIONNAIRE

GUIDANCE TO QUESTIONNAIRE

The short guideline to each part of the questionnaire is as follow:

BASIC DATA
If data for GNP is not available, data for GDP can be used instead. (Please specify the type of GDP you have used, ie if they are GDP by market price or factor cost or constant price, in the latter case please mention the base year.

I HEALTH EXPENDITURE BY SOURCE OF FINANCE

This part is intended for recording how these services were funded. The main divisions are between public finance; payments by consumers; and payments by others, such as charities and voluntary organisations within public finance, the principal is breakdown funding from general taxation and that from compulsory insurance or social security. Under payments by consumers are included private, voluntary insurance and charges that consumers are unable to recover from any third party.

II HEALTH EXPENDITURE BY OWNERSHIP/ADMINISTRATION OF PROVISION

This part sought to examine the mix of public and private organisations through which health services are delivered. The breakdown has three main parts: government institutions, owned and run by the State, non-government institutions, not run for profit, such as voluntary hospitals and charities; and private, for profit institutions, contractors and practitioners. What ever does not fit to these classifications comes under other category.

III HEALTH EXPENDITURE BY SERVICES

The third of these section assumed that health services comprise the following (for the whole population, including the armed forces and all other specific groups):

1 hospital and similar institutional medical services, whether provided on an in-patient or ambulatory basis;
2 primary and specialist health care outside hospitals;
3 rural health centres
4 self-care (which in practice proved to be the cost of self-medicatyn or of drugs purchased without prescription);
5 public-health services (including immunization and other preventive activities, health education, and the medical supervision of environmental services);
6 medical and health-services research;
7 training of health-services personnel;
8 administration of these services.

Capital expenditure was to be included but shown separately for hospital services and for services outside the hospital and health care. National charges of capital against running costs, such as amortization and depreciation, were to be deducted from running costs to avoid double counting. Social-Welfare services were excluded, as were cash benefits except to the extent that these were used to pay for health services. Consequential Costs borne by families and the community as a result of ill health, such as waiting time and lost earnings were also excluded.

IV HEALTH EXPENDITURE BY RESOUCES

The last of four sections is concerned with the health-care spending by resource category. Staff employed, the largest category, is broken down bY occupational group, among doctors (general practice and all others); Dentists, (general practice and all others); Nurses; (one and two the reason is that in some countries nurses are classified as registered and qualified in some countries qualified and non-qualified etc, therefore when answering this part please mention which lassification you used and what is one (1) and what is (2); midwives (1 and 2 see nurses); Medical aide, Nursing aids; Dispenseries and Village health workers. Also staff employed is broken down by kind of care, ie primary care, secondary care and tartiary care. Staff employed breakdown countries by professional and technical; and administrative, clerical and auxiliary staff. Pharmaceuticals is sub-divided between prescribed and non-prescribed (ie over the counter). Equipment and suoplies is meant to cover the purchase, repair and maintenance of equipment, as well as supply items, whether medical or non-medical. The fourth category, building is intended to include expenditure on new buildings and on the adaption and repair of existing buildings (excluding work carried out by personnel directly employed, since this would appear under staff employed). "other health expenditure" is the final, residual category of resource expenditures.

HEALTH EXPENDITURE ANALYSIS

		60	65	70	75	80
BASIC DATA						
1	Population (thousand)					
2	GNP					
3	GNP Per Capital					
I	HEALTH EXPENDITURE BY SOURCE OF FINANCE					
4	Public					
	(a) General taxation					
	(b) Compulsory Insurance/Social Security					
	(c) Other (specify)					
5	**Consumers**					
	(a) Voluntary Insurance					
	(b) Direct payment					
	(c) Other (specify)					
6	**Other (specify)**					
7	**Total Expenditure**					
	(a) Total					
	(b) Per Capital					
	(c) Percentage of GNP					
	(d) Percentage of GDP					

continued...

		60	65	70	75	80
II	HEALTH EXPENDITURE BY OWNERSHIP/ ADMINISTRATION OF PROVISION					
8	**Total of Health Expenditure by Ownership**					
	(a) Government Institutions (state-owned and run)					
	(b) Non-Government, Not for Profit					
	(c) Private, For Profit Institution and Contractors					
	(d) Others (specify)					
III	HEALTH EXPENDITURE BY SERVICES					
9	**Hospitals (Current, Excluding AMortization)**					
	(a) In-patient					
	(b) Out-patient					
10	**Hospitals (Capital)**					
11	**Care Outside Hospitals**					
	(a) Primary Care					
	(b) Specialist Care					
	(c) Capital expenditure					
12	**Selfcare**					

continued...

	Primary Care					Secondary Care					Tertiary Care				
	60	65	70	75	80	60	65	70	75	80	60	65	70	75	80
(d) Midwives (1) Midwives (2)															
(e) Medical Aids															
(f) Nursing Aids															
(g) Dispensors															
(h) Village Health Visitors															

		60	65	70	75	80
18	**Professional and Technical**					
19	**Administrative and Clerical**					
20	**Auxiliary**					
21	**Total Staff Employed**					
22	Pharmaceutical (a) Prescribed (b) OTC drugs					
23	Equipment and Supplies					
24	Building					
25	Other Health Expenditure					
26	Total (22-25)					

APPENDIX A-3

GRAPHICAL REPRESENTATION OF DATA

FIGURE A3-1: MORTALITY RATE FOR 1961 TO 1980 (BOTSWANA).

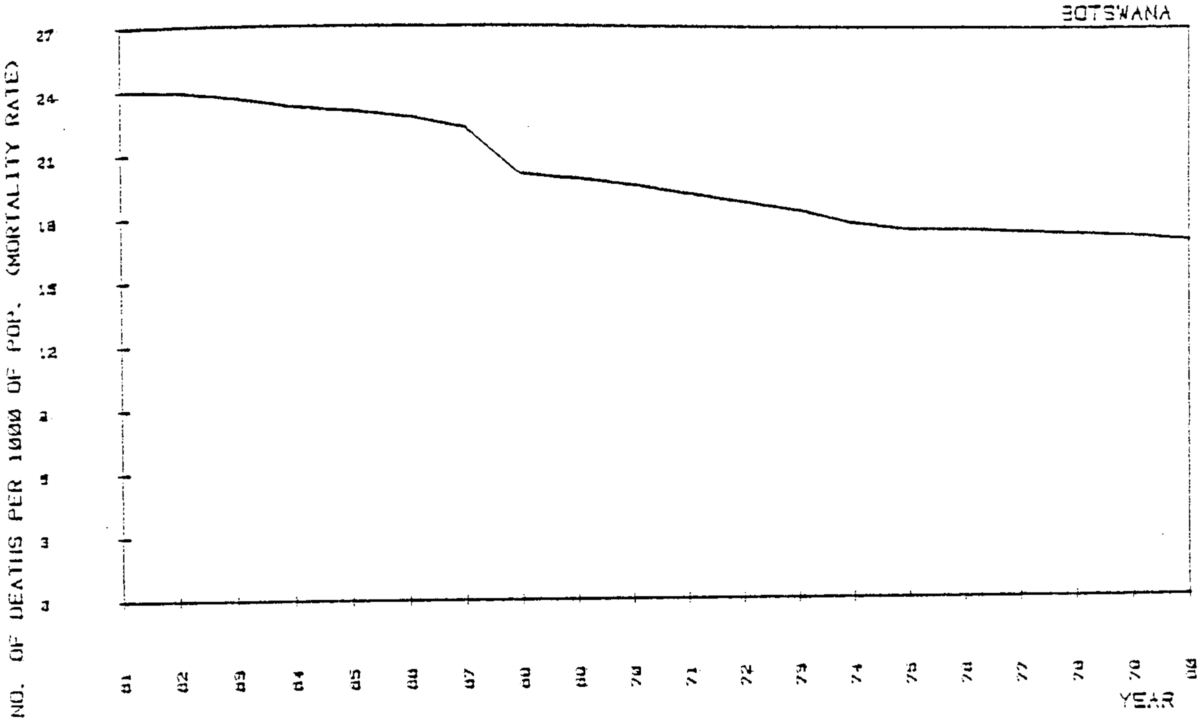
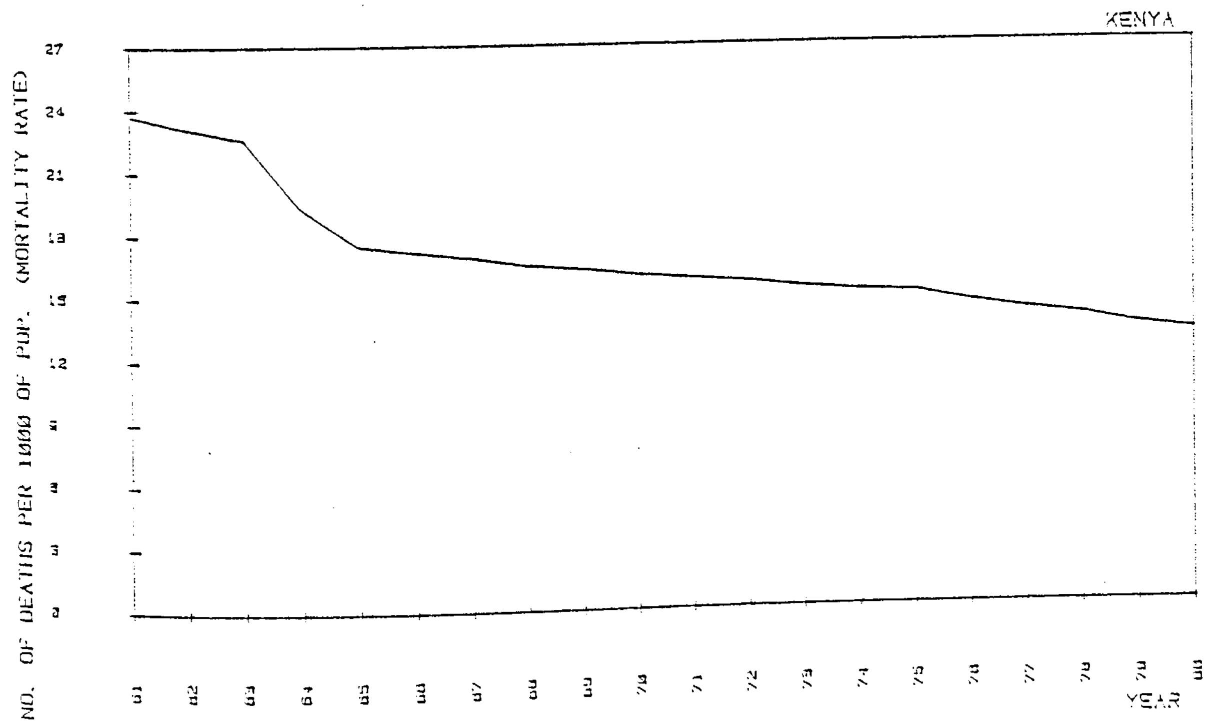


FIGURE A3-2: MORTALITY RATE FOR 1961 TO 1980 (KENYA).



Continued ...

FIGURE A3-3: MORTALITY RATE FOR 1961 TO 1980 (MAURITIUS).

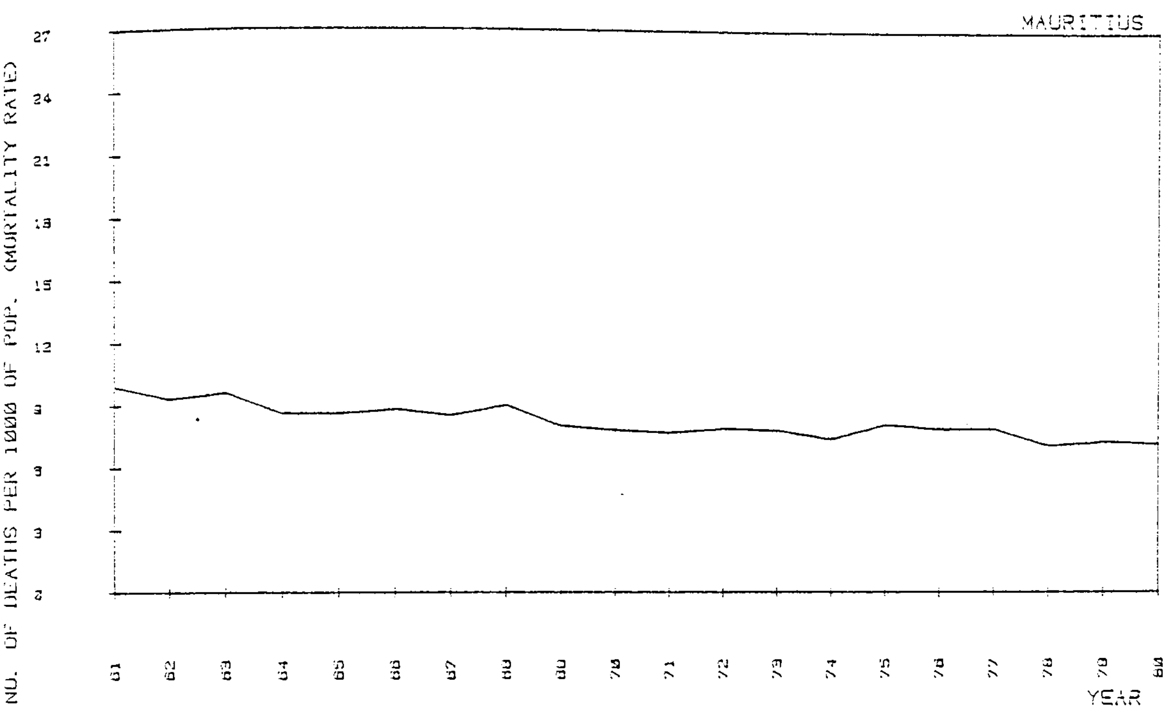
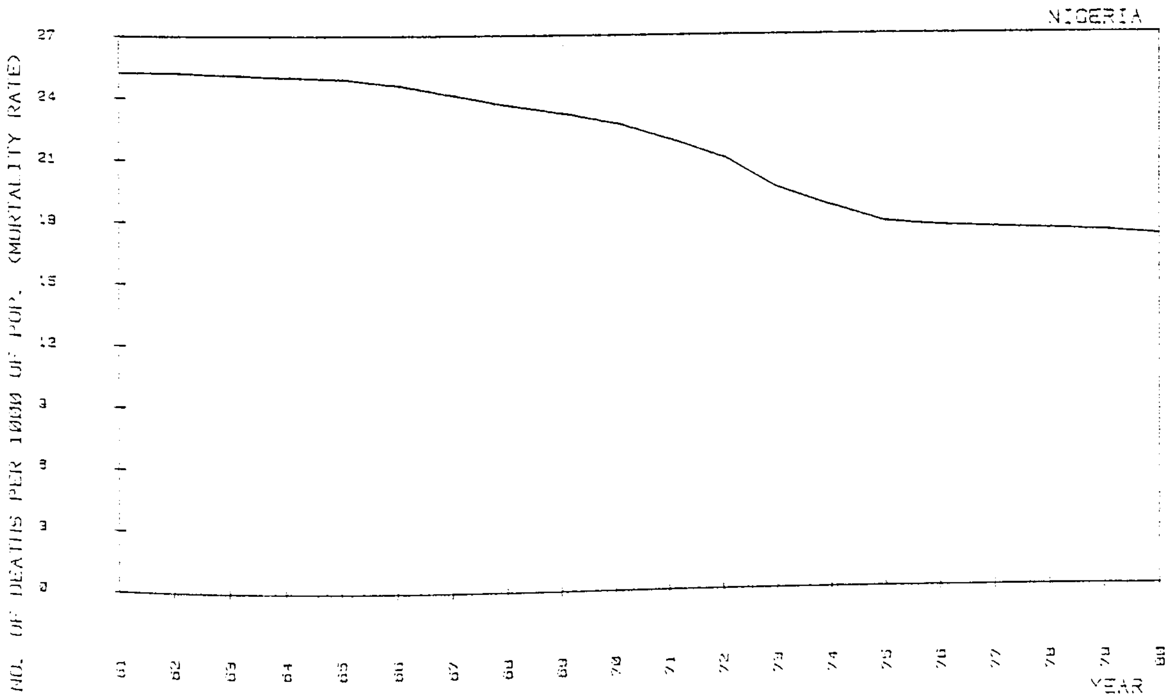


FIGURE A3-4: MORTALITY RATE FOR 1961 TO 1980 (NIGERIA).



Continued ...

FIGURE A3-5: MORTALITY RATE FOR 1961 TO 1980 (SWAZILAND).

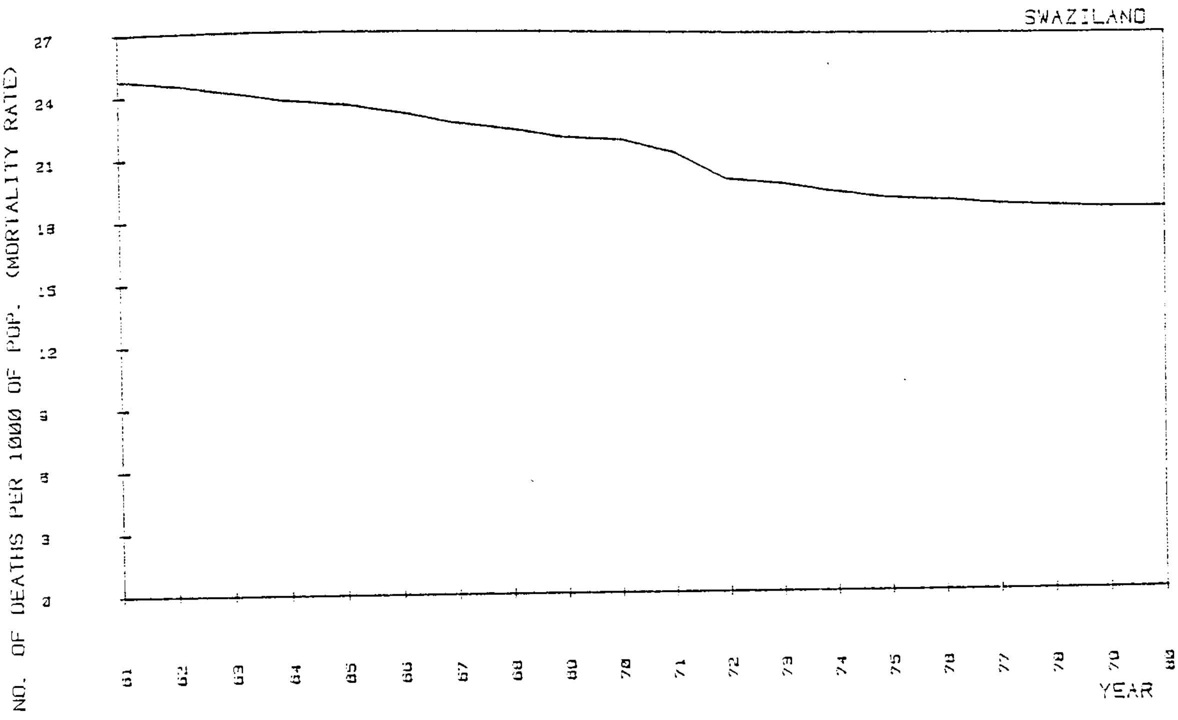
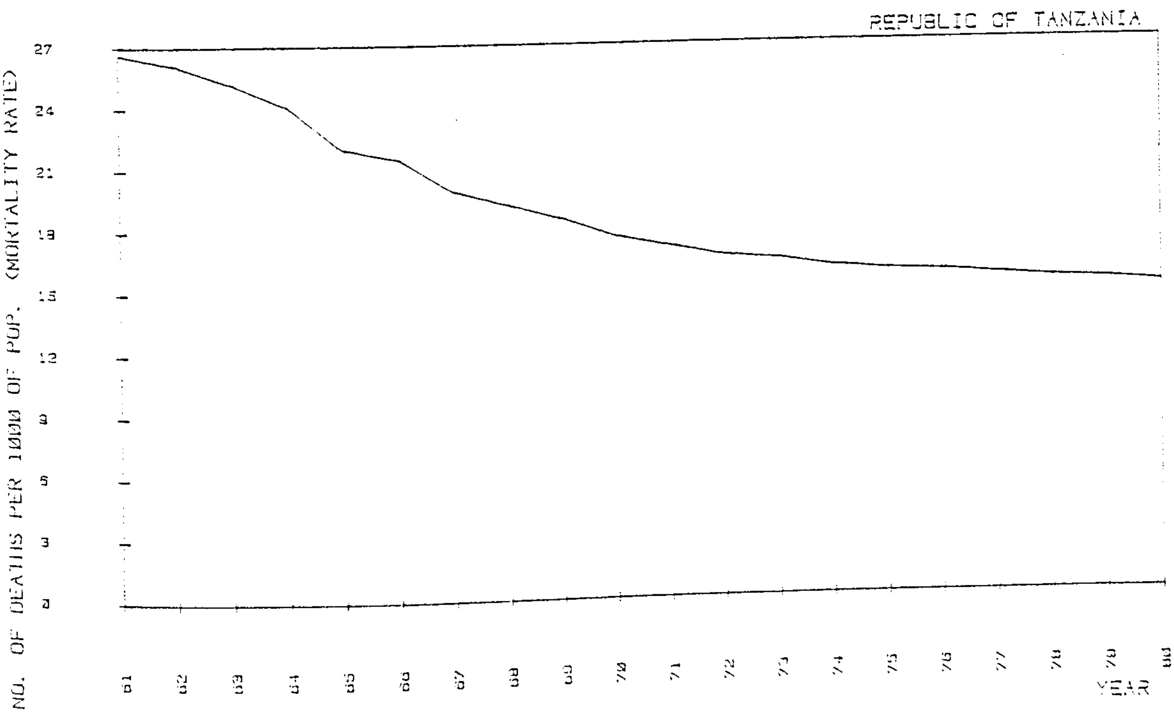


FIGURE A3-6: MORTALITY RATE FOR 1961 TO 1980 (TANZANIA).



Continued ...

FIGURE A3-7: LIFE EXPECTANCY AT BIRTH FOR 1961 TO 1980 (BOTSWANA).

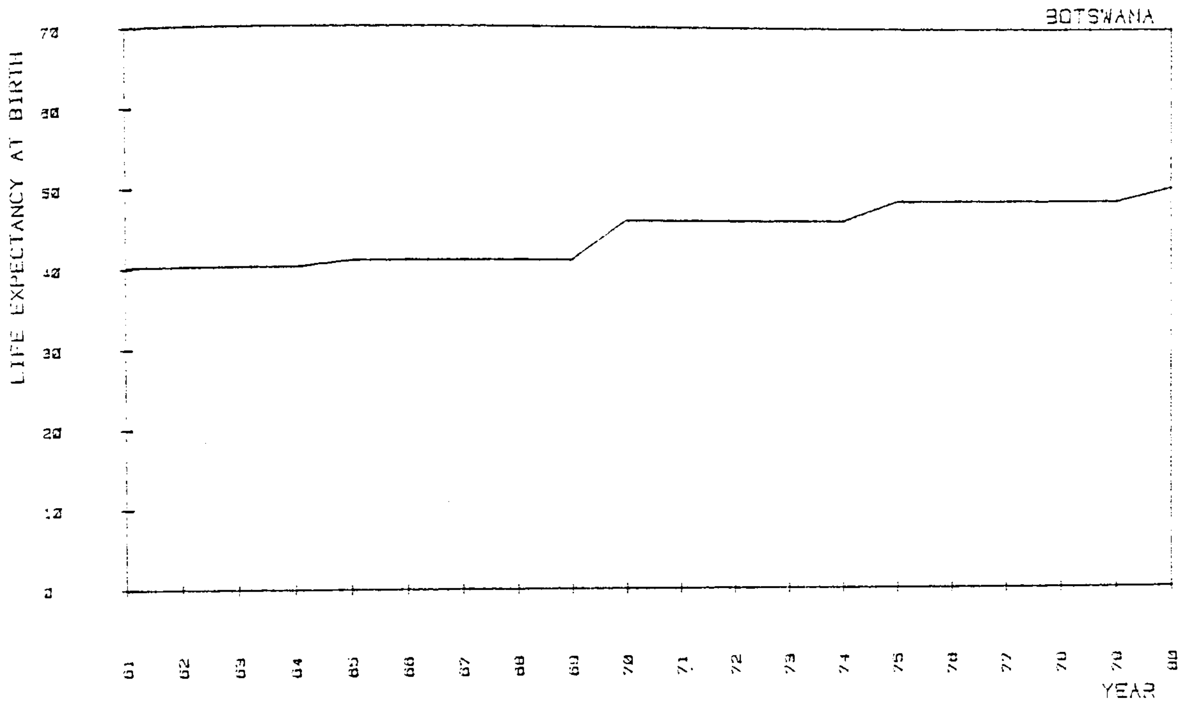
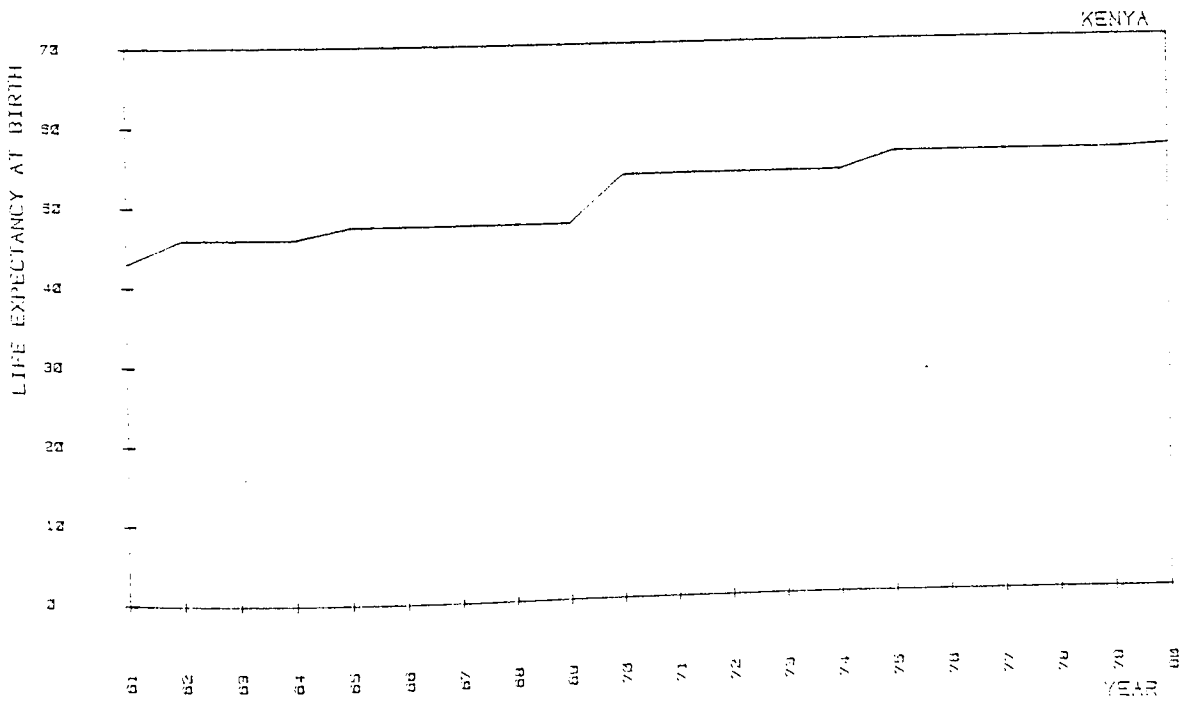


FIGURE A3-8: LIFE EXPECTANCY AT BIRTH FOR 1961 TO 1980 (KENYA).



Continued ...

FIGURE A3-9: LIFE EXPECTANCY AT BIRTH FOR 1961 TO 1980 (MAURITIUS).

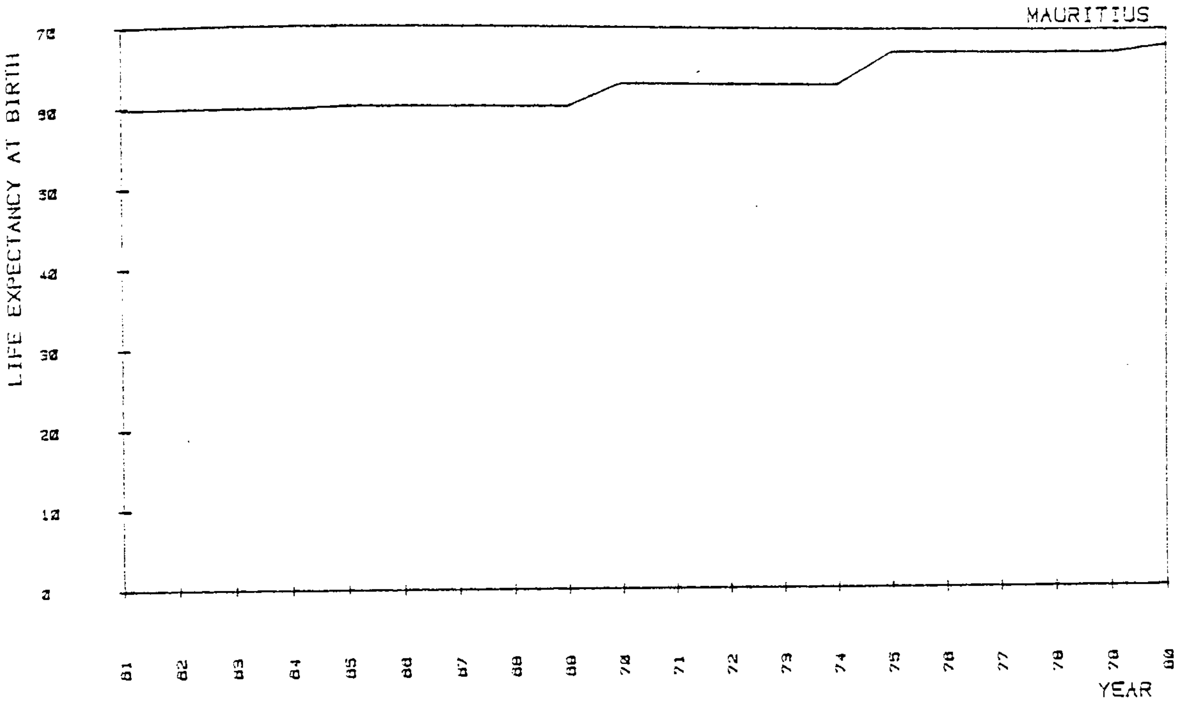
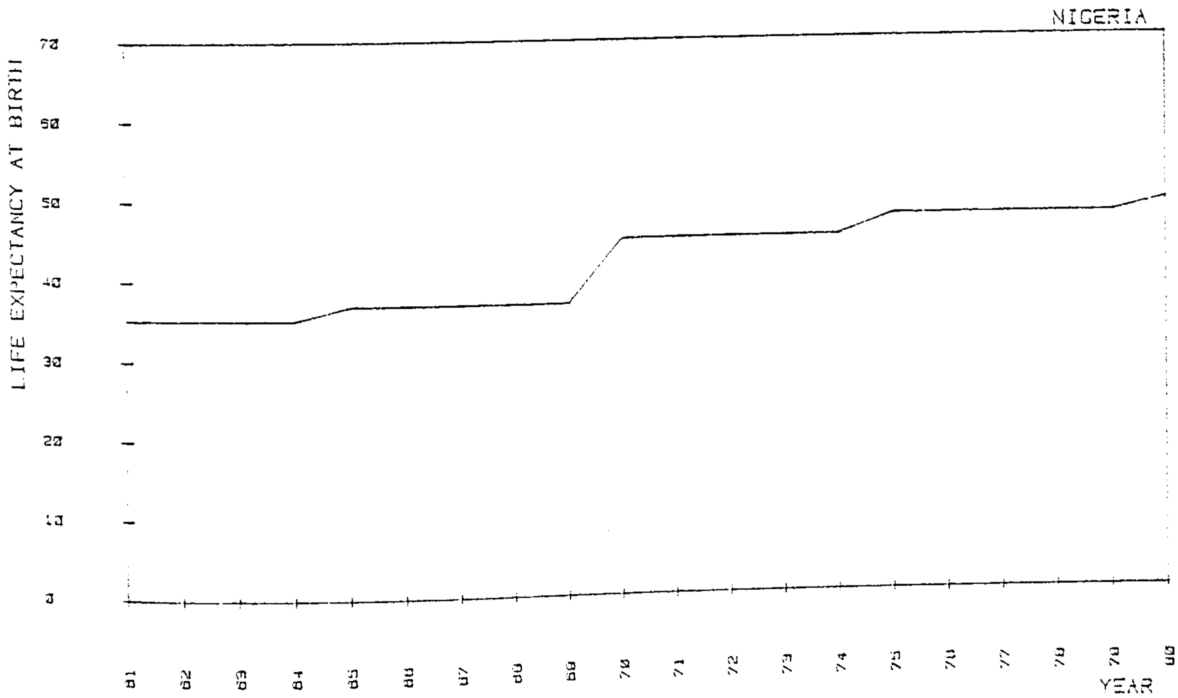


FIGURE A3-10: LIFE EXPECTANCY AT BIRTH FOR 1961 TO 1980 (NIGERIA).



Continued ...

FIGURE A3-11: LIFE EXPECTANCY AT BIRTH FOR 1961 TO 1980 (SWAZILAND).

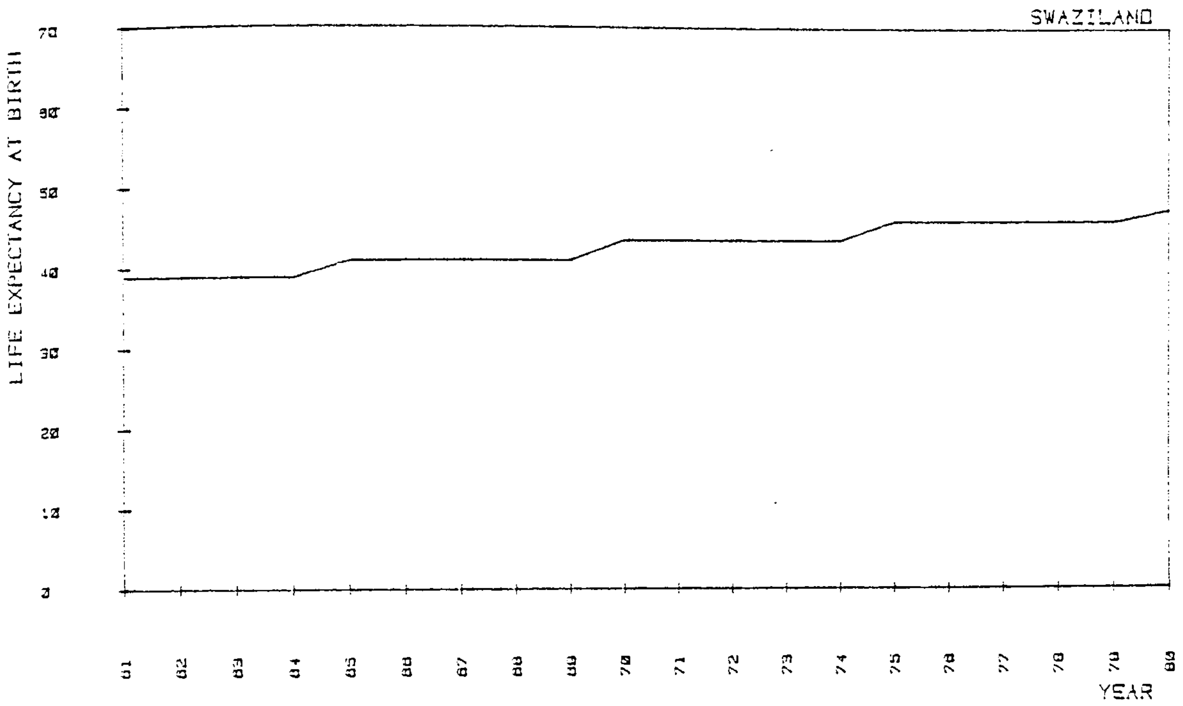
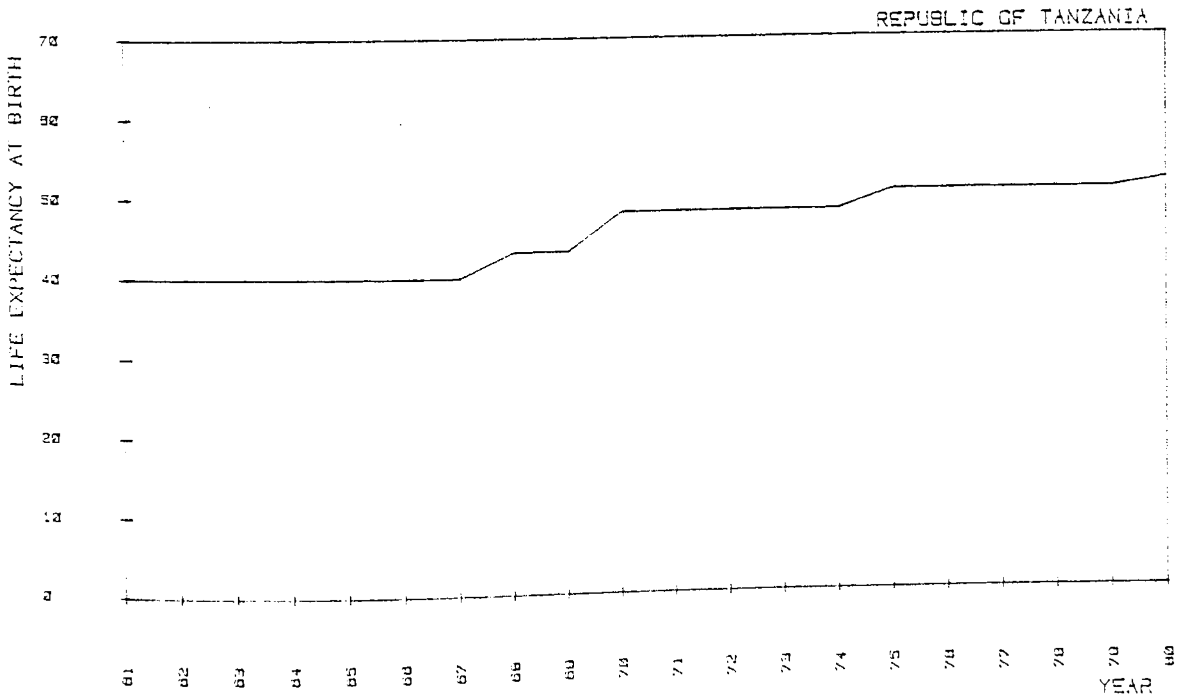


FIGURE A3-12: LIFE EXPECTANCY AT BIRTH FOR 1961 TO 1980 (TANZANIA).



Continued ...

FIGURE A3-13: URBANISATION (NUMBER OF PEOPLE LIVING IN CITIES AS PERCENTAGE OF POPULATION). (1961 - 1980)

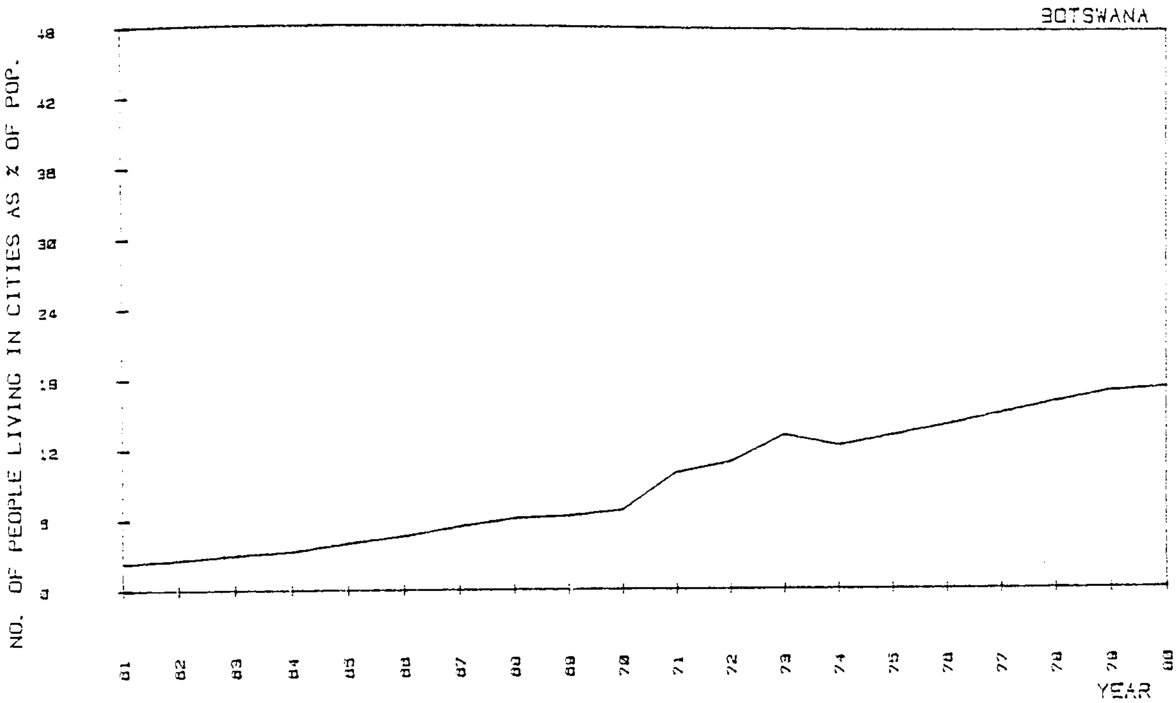
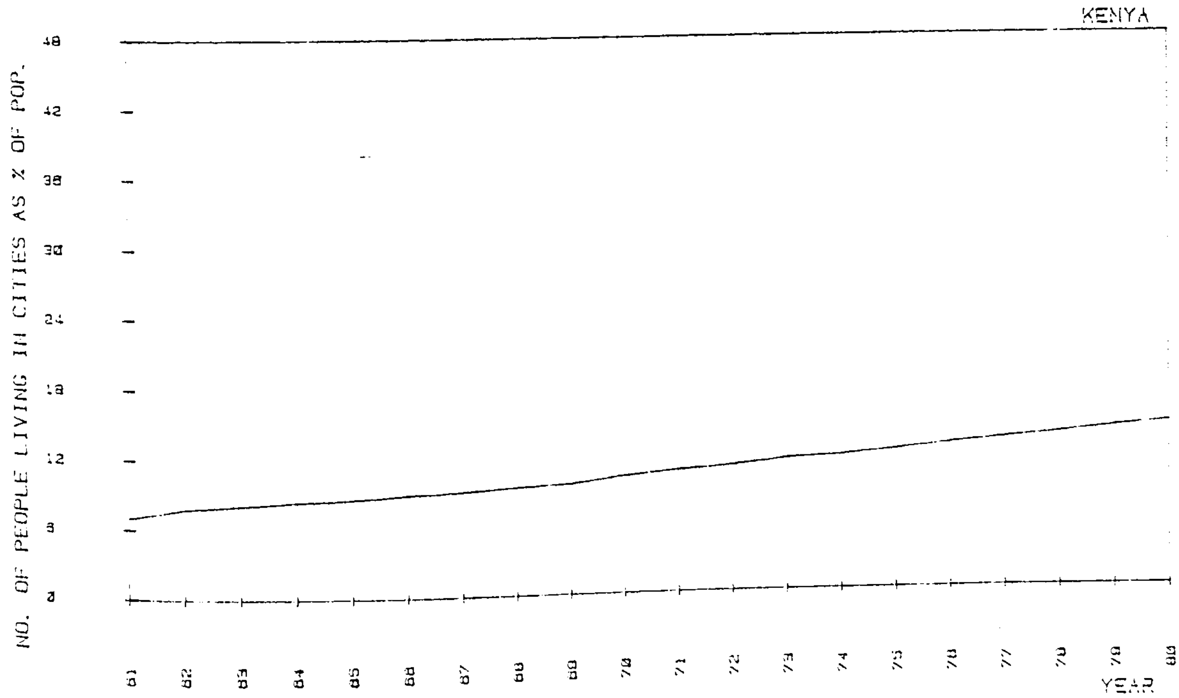


FIGURE A3-14: URBANISATION (NUMBER OF PEOPLE LIVING IN CITIES AS PERCENTAGE OF POPULATION). (1961 - 1980)



Continued ...

FIGURE A3-15: URBANISATION (NUMBER OF PEOPLE LIVING IN CITIES AS PERCENTAGE OF POPULATION). (1961 - 1980)

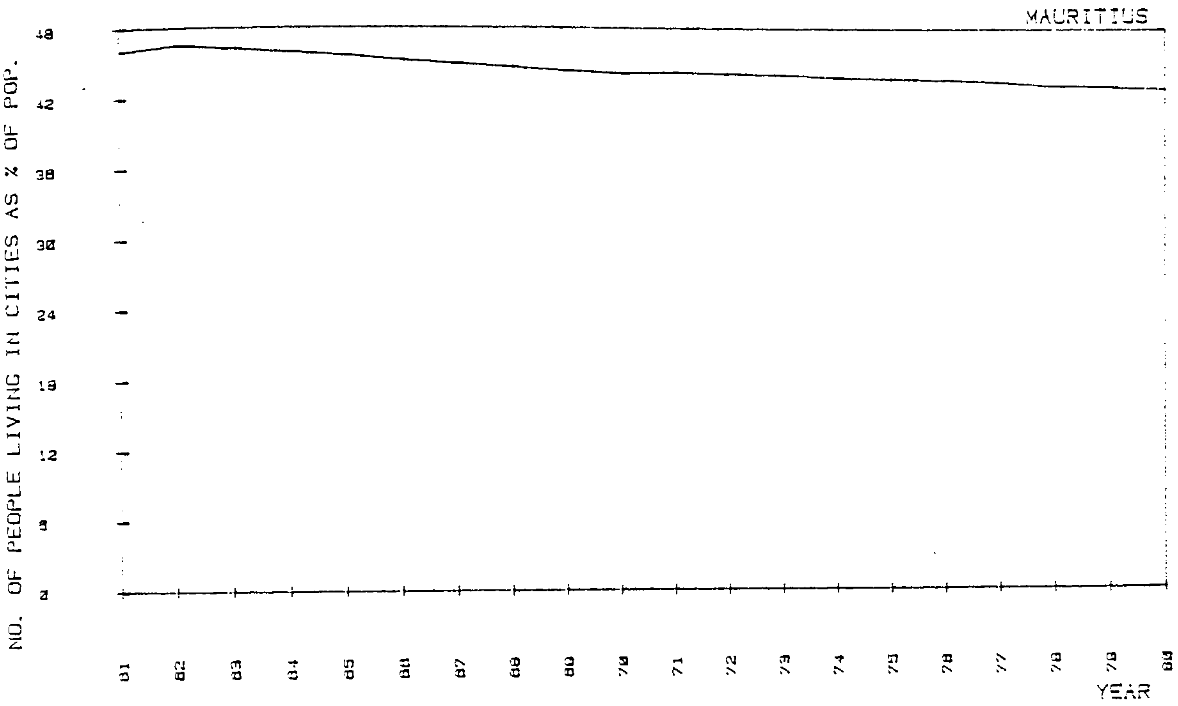
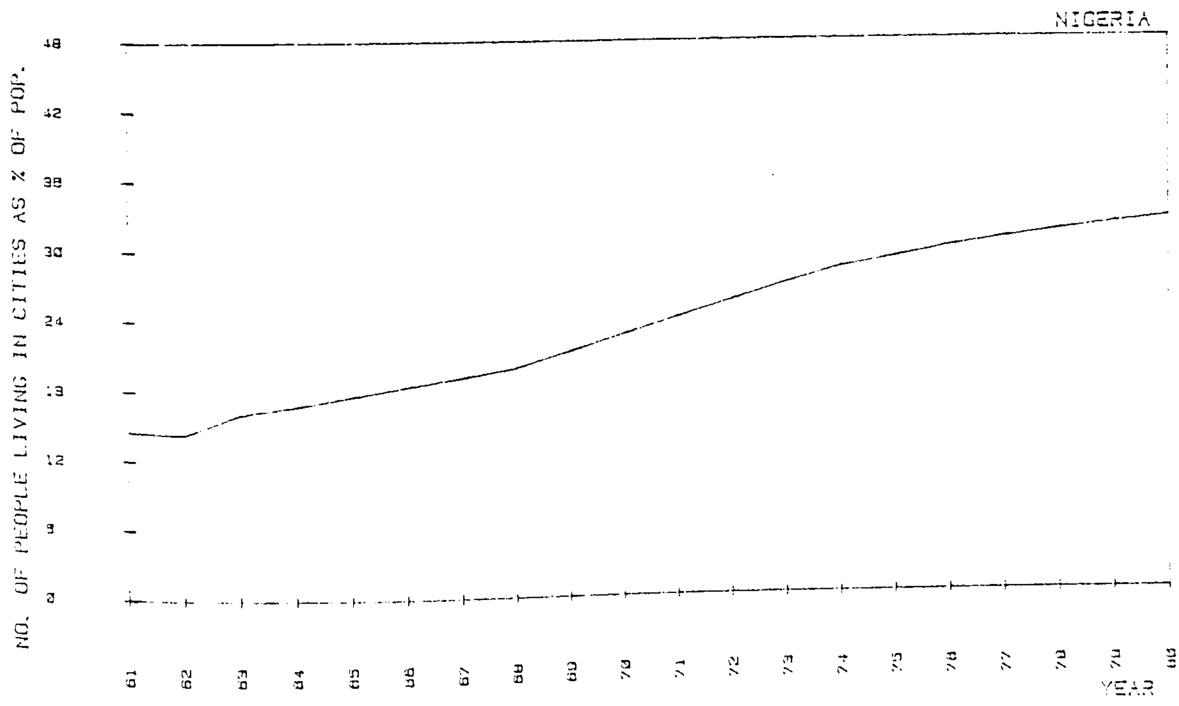


FIGURE A3-16: URBANISATION (NUMBER OF PEOPLE LIVING IN CITIES AS PERCENTAGE OF POPULATION). (1961 - 1980)



Continued ...

FIGURE A3-17: URBANISATION (NUMBER OF PEOPLE LIVING IN CITIES AS PERCENTAGE OF POPULATION). (1961 - 1980)

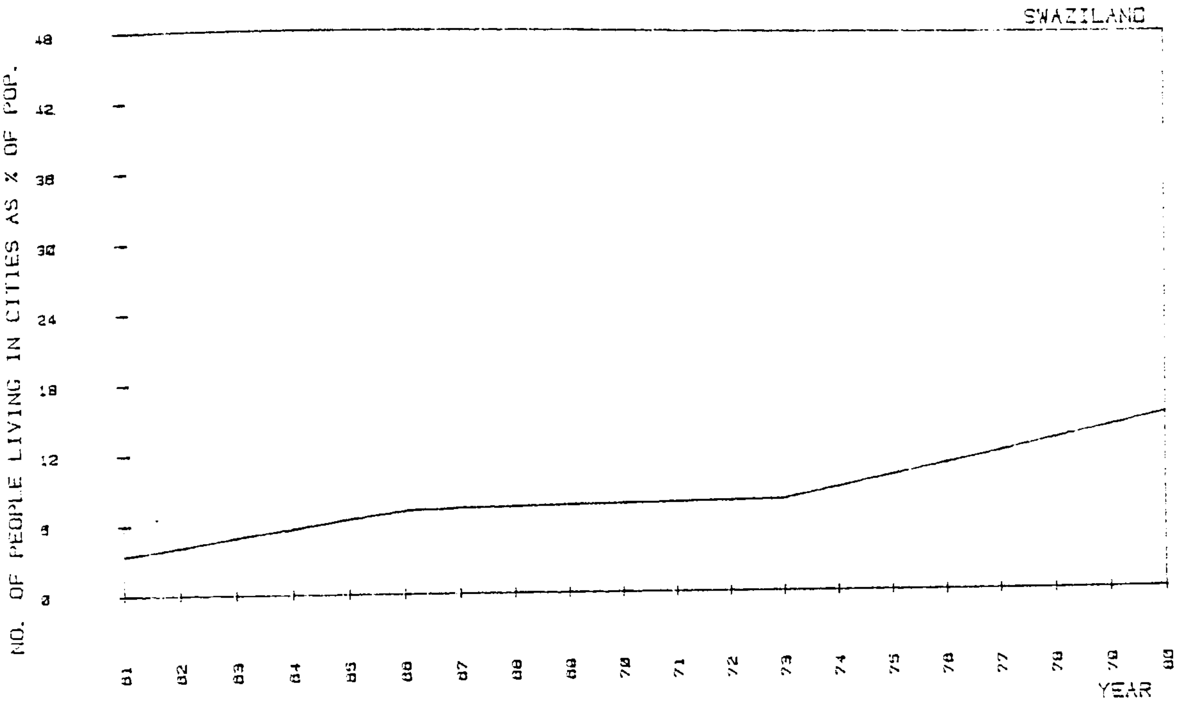
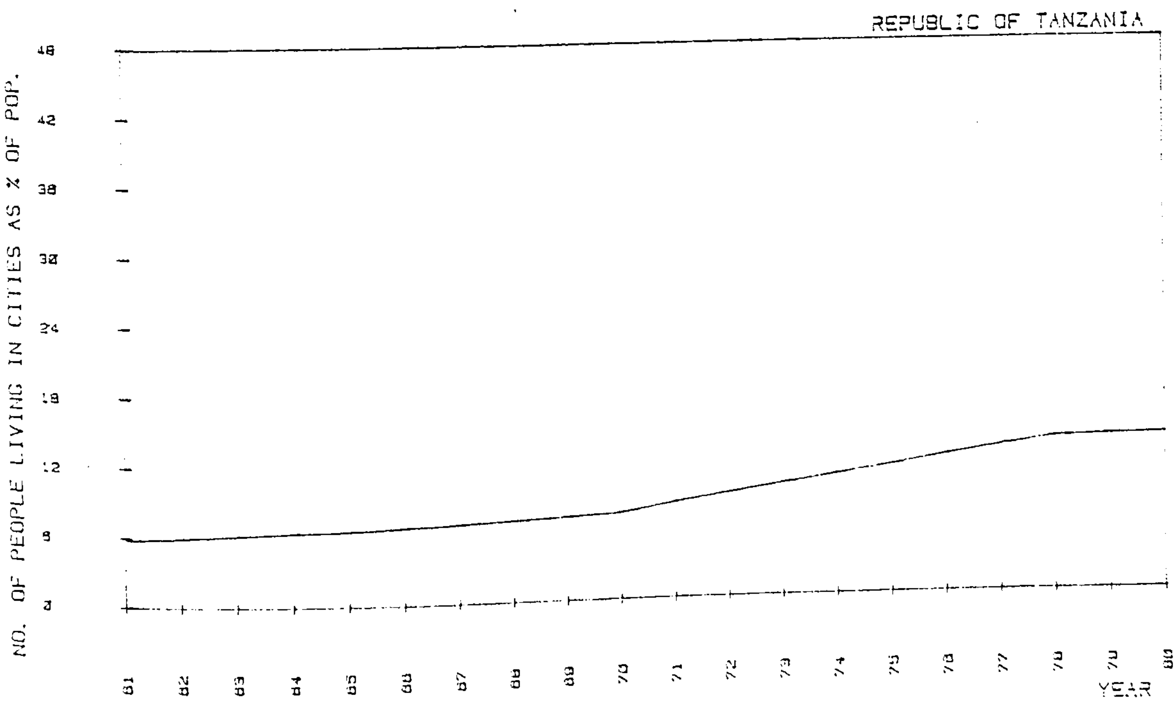


FIGURE A3-18: URBANISATION (NUMBER OF PEOPLE LIVING IN CITIES AS PERCENTAGE OF POPULATION). (1961 - 1980)



Continued ...

FIGURE A3-19: NUMBER OF PRIMARY STUDENTS AS PERCENTAGE OF POPULATION.
(1961 - 1979)

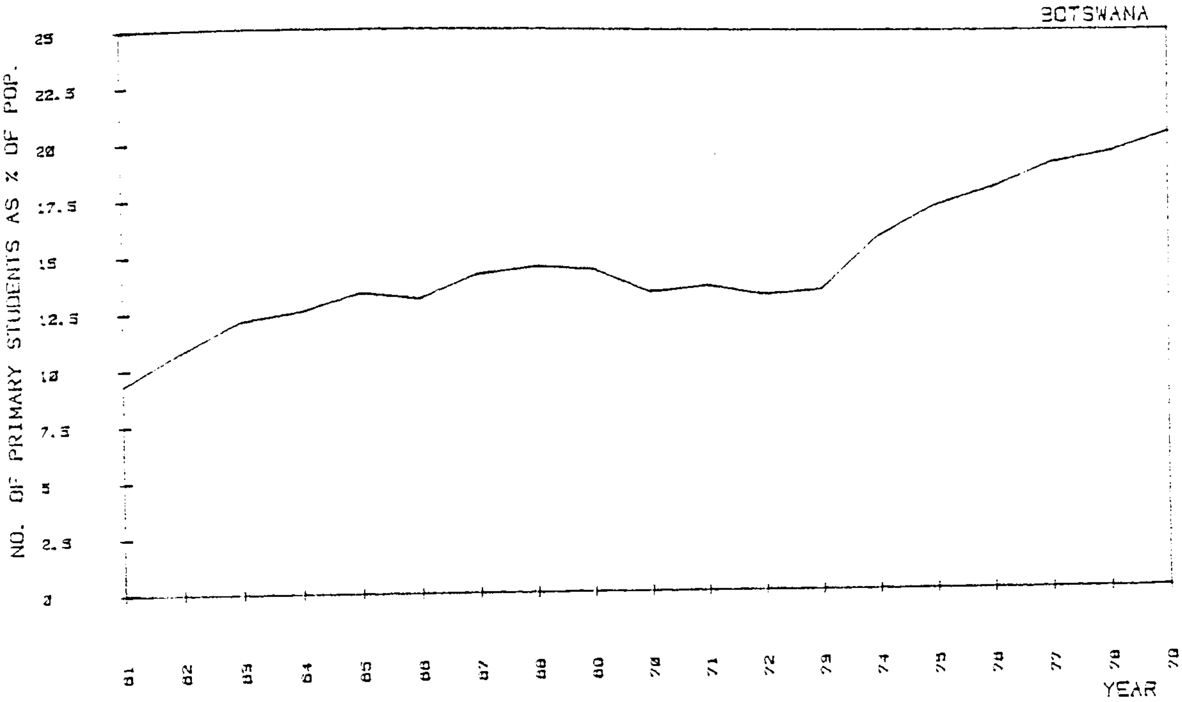


FIGURE A3-20: NUMBER OF PRIMARY STUDENTS AS PERCENTAGE OF POPULATION.
(1961 - 1980)

Continued ...

FIGURE A3-21: NUMBER OF PRIMARY STUDENTS AS PERCENTAGE OF POPULATION. (1961 - 1980)

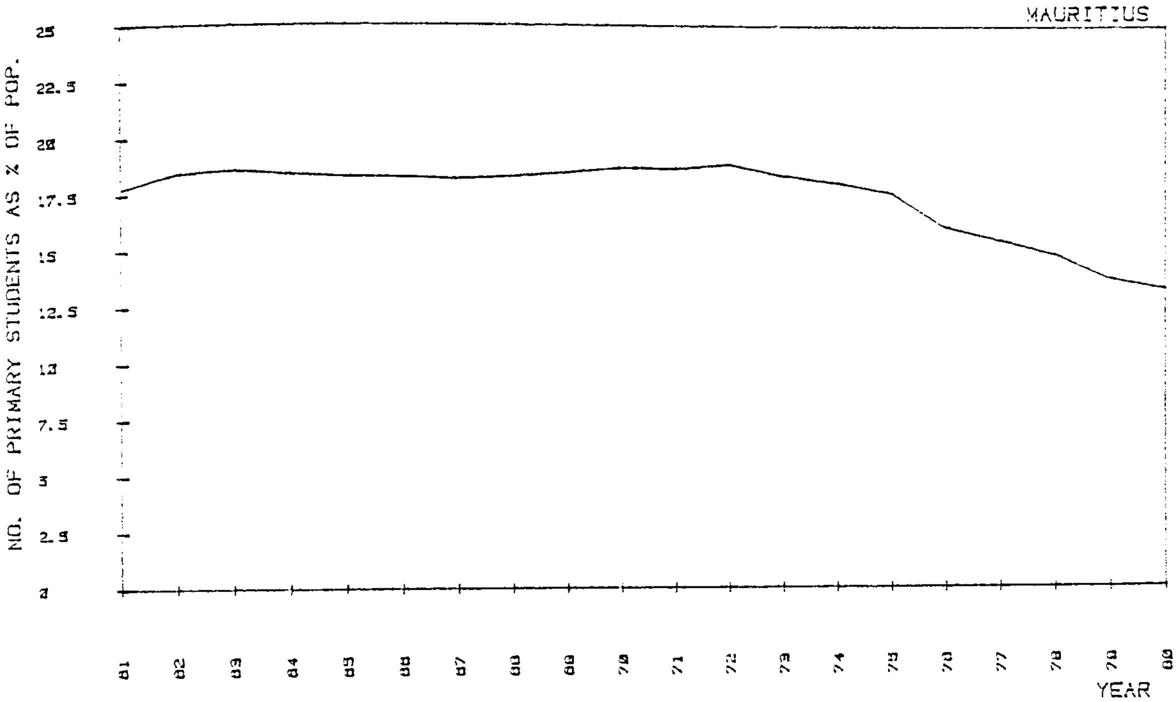
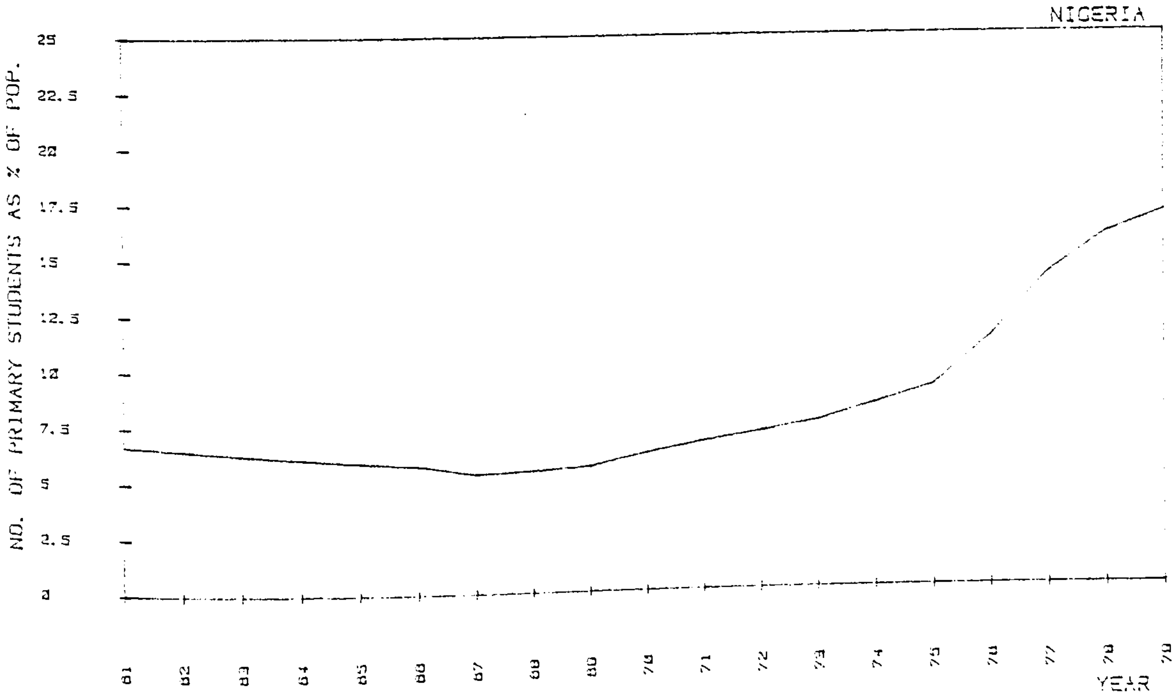


FIGURE A3-22: NUMBER OF PRIMARY STUDENTS AS PERCENTAGE OF POPULATION. (1961 - 1979)



Continued ...

FIGURE A3-23: NUMBER OF PRIMARY STUDENTS AS PERCENTAGE OF POPULATION.
(1961 - 1980)

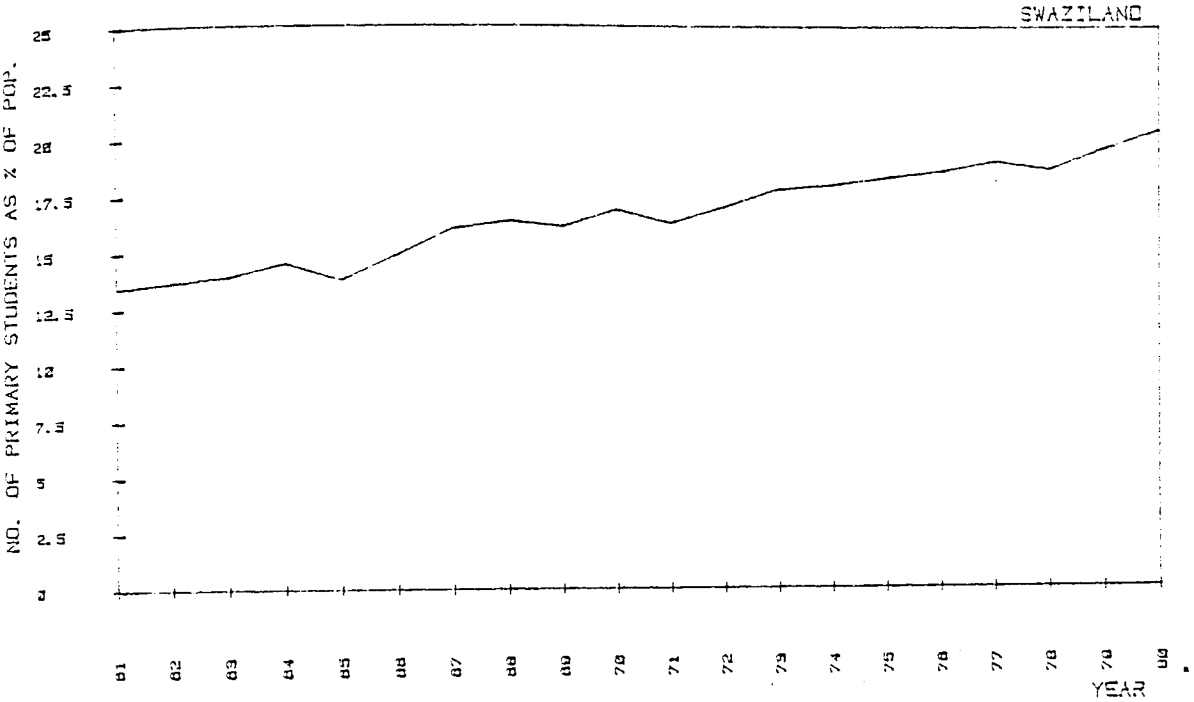
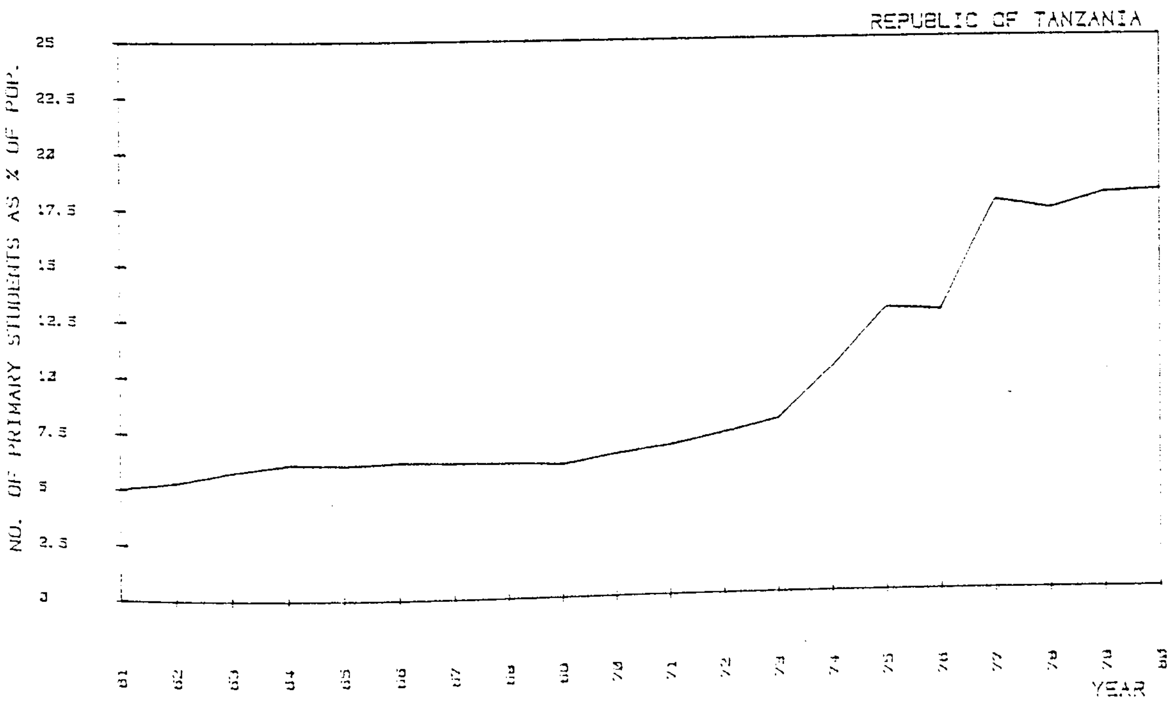


FIGURE A3-24: NUMBER OF PRIMARY STUDENTS AS PERCENTAGE OF POPULATION.
(1961 - 1980)



Continued ...

FIGURE A3-25: TOTAL EXPENDITURE ON EDUCATION BY GOVERNMENT.
(1961 - 1980)

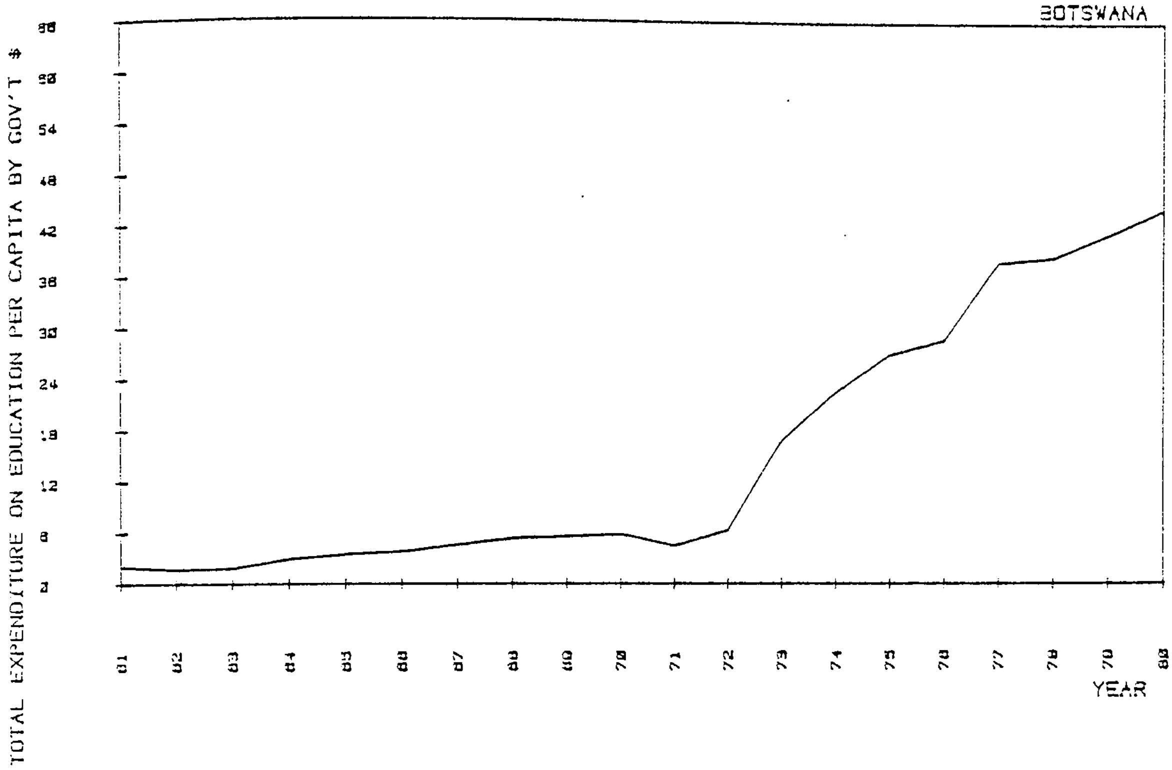
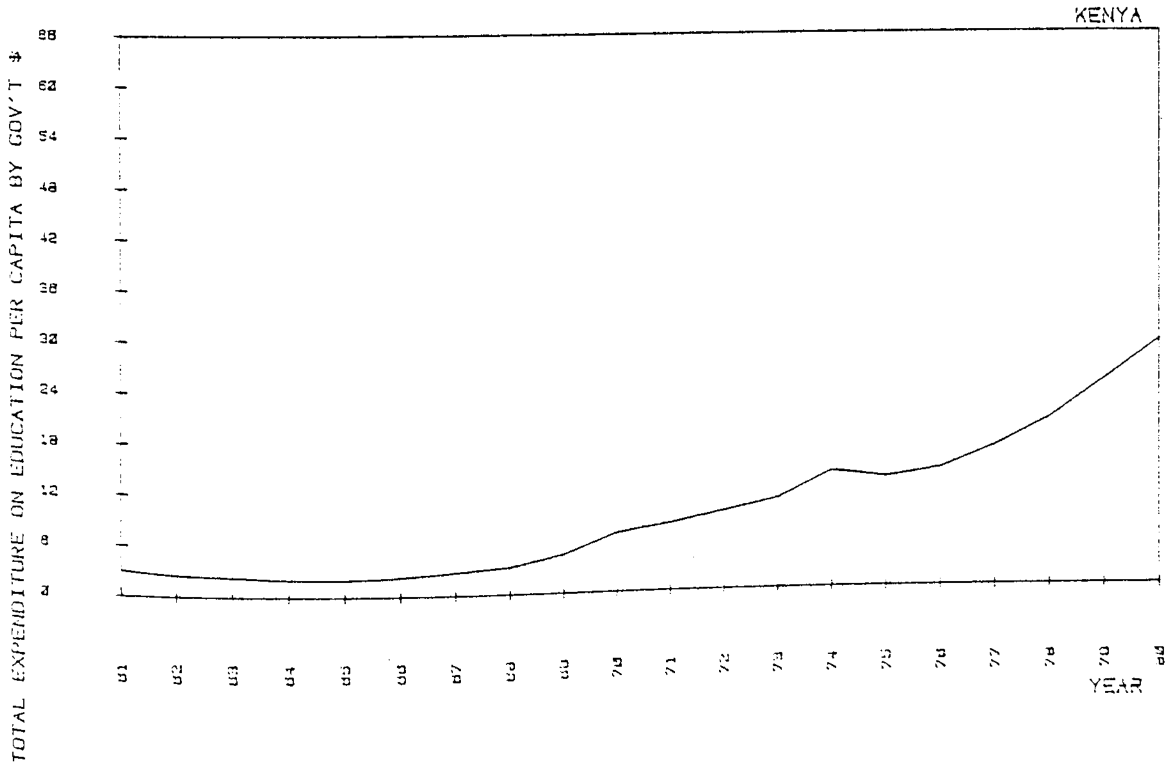


FIGURE A3-26: TOTAL EXPENDITURE ON EDUCATION BY GOVERNMENT.
(1961 - 1980)



Continued ...

FIGURE A3-27: TOTAL EXPENDITURE ON EDUCATION BY GOVERNMENT.
(1961 - 1980)

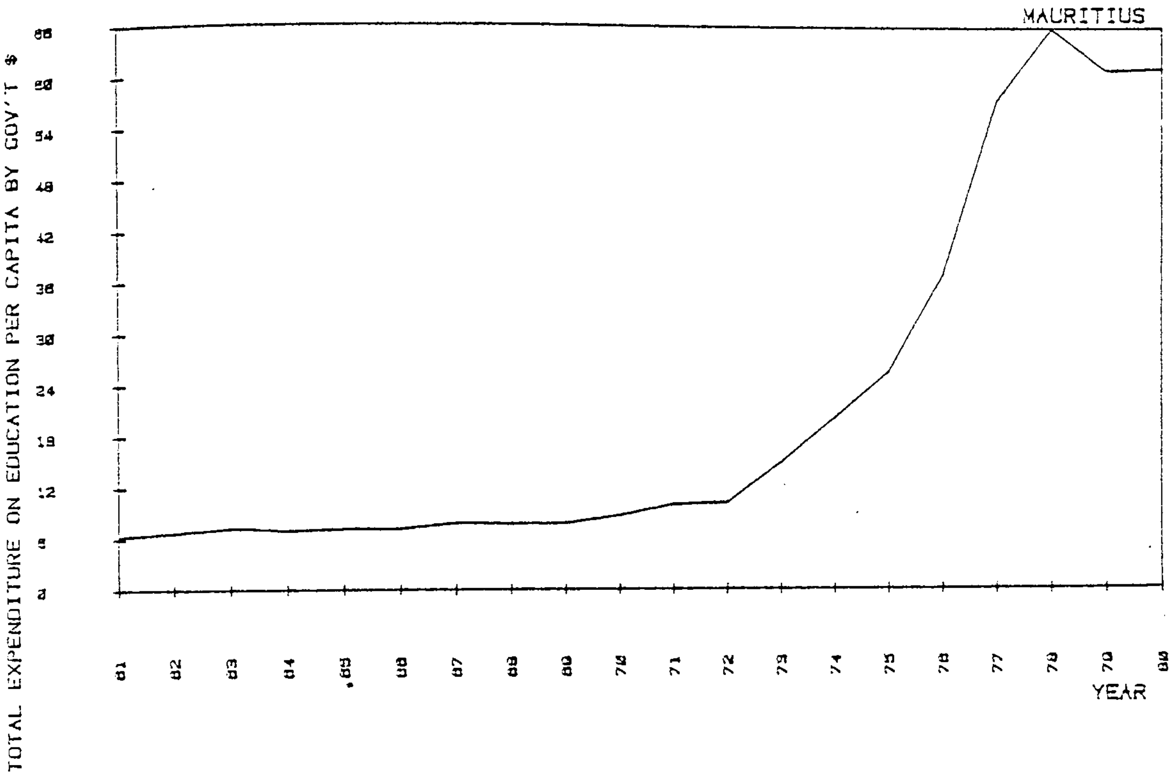
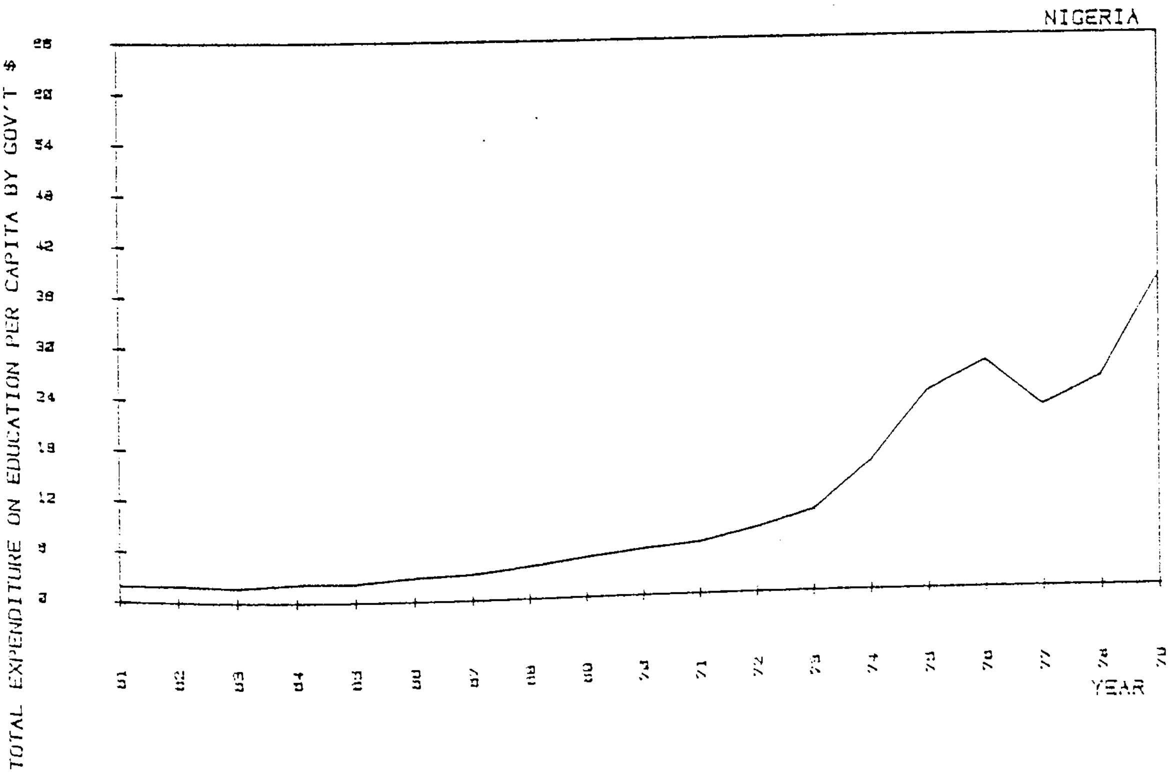


FIGURE A3-28: TOTAL EXPENDITURE ON EDUCATION BY GOVERNMENT.
(1961 - 1979)



Continued ...

FIGURE A3-29: TOTAL EXPENDITURE ON EDUCATION BY GOVERNMENT. (1961 - 1979)

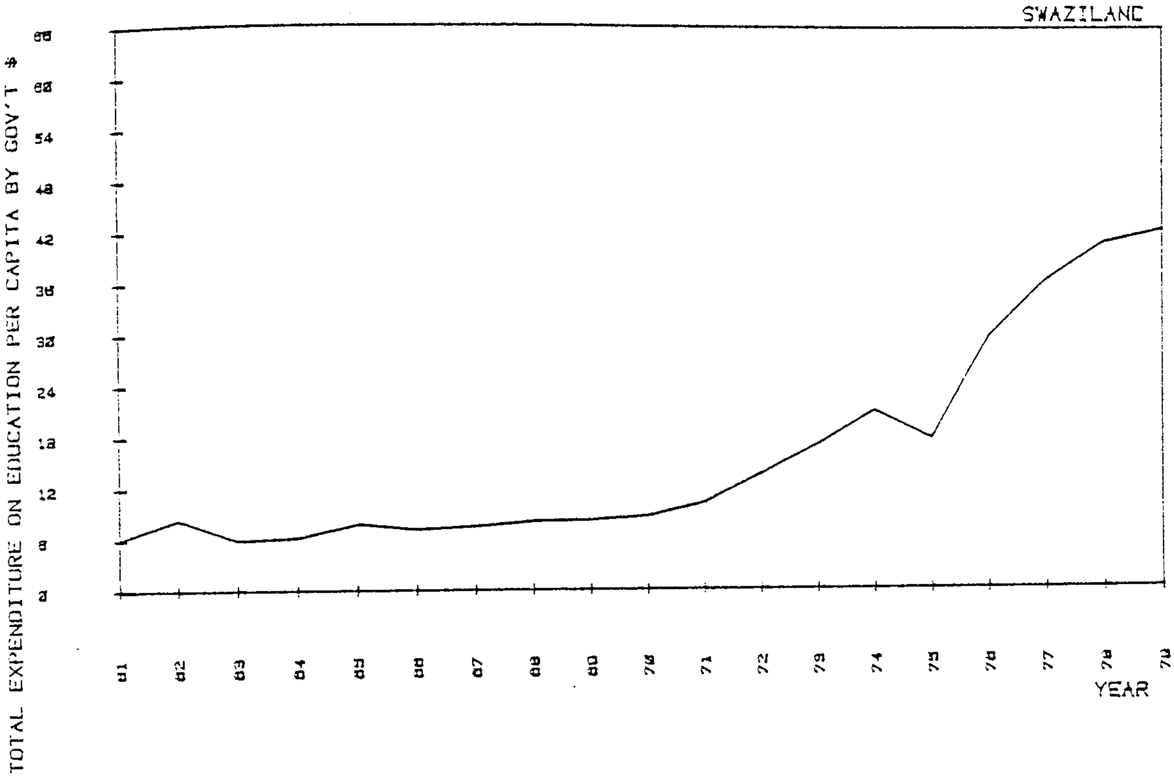
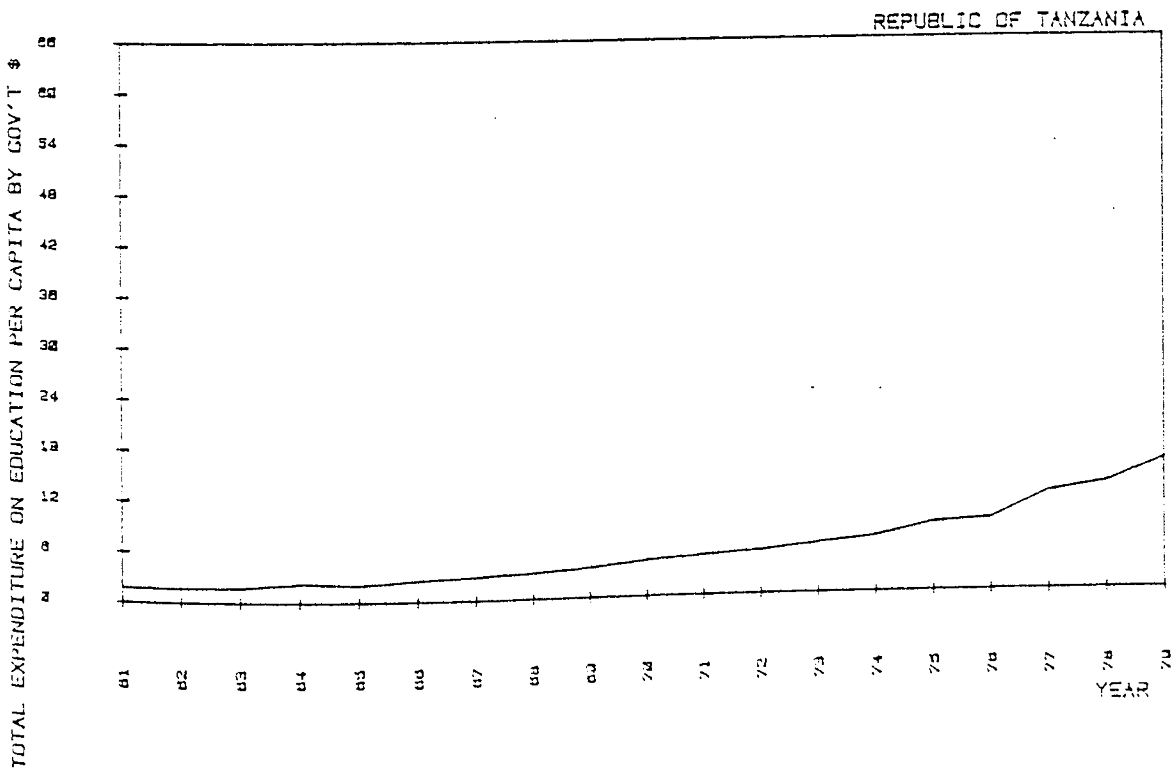


FIGURE A3-30: TOTAL EXPENDITURE ON EDUCATION BY GOVERNMENT. (1961 - 1979)



Continued ...

FIGURE A3-31: RECURRENT EXPENDITURE ON EDUCATION BY GOVERNMENT.

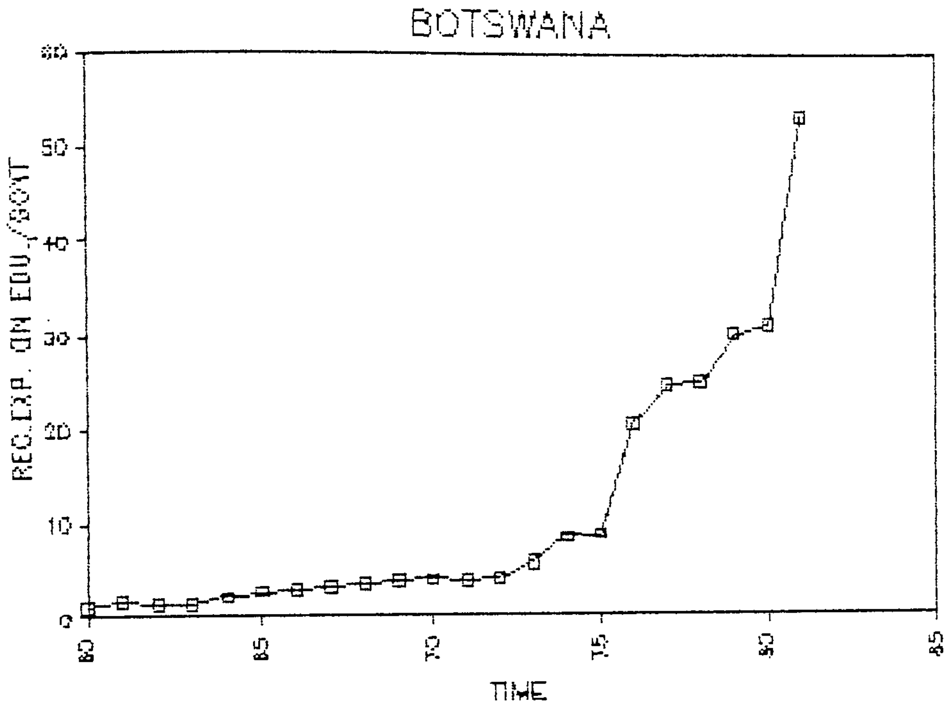


FIGURE A3-32: RECURRENT EXPENDITURE ON EDUCATION BY GOVERNMENT.

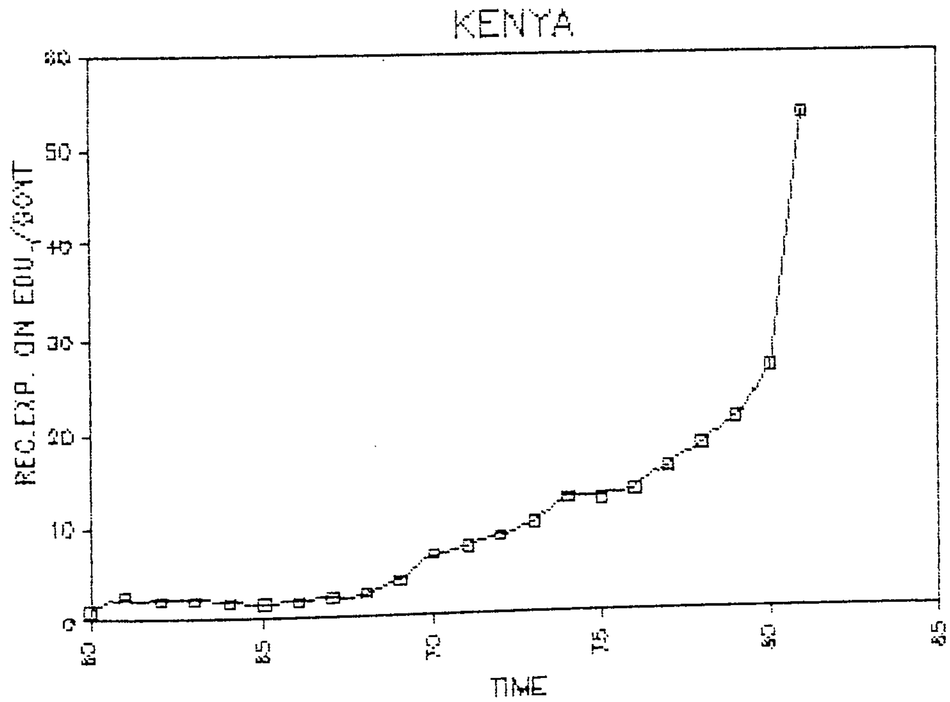


FIGURE A3-33: RECURRENT EXPENDITURE ON EDUCATION BY GOVERNMENT.

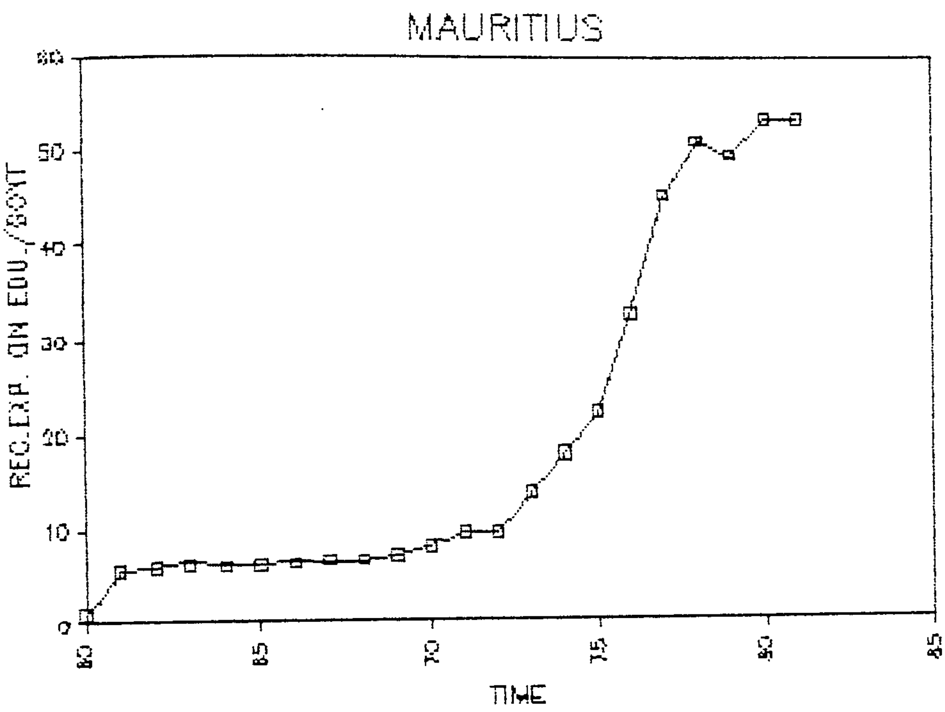


FIGURE A3-34: RECURRENT EXPENDITURE ON EDUCATION BY GOVERNMENT.

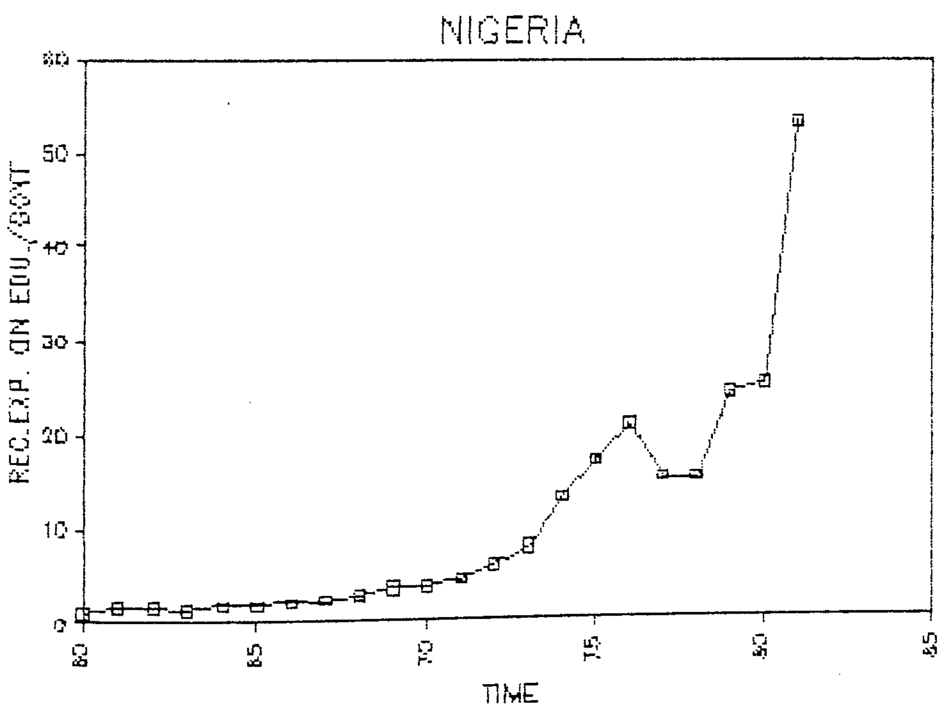


FIGURE A3-35: RECURRENT EXPENDITURE ON EDUCATION BY GOVERNMENT.

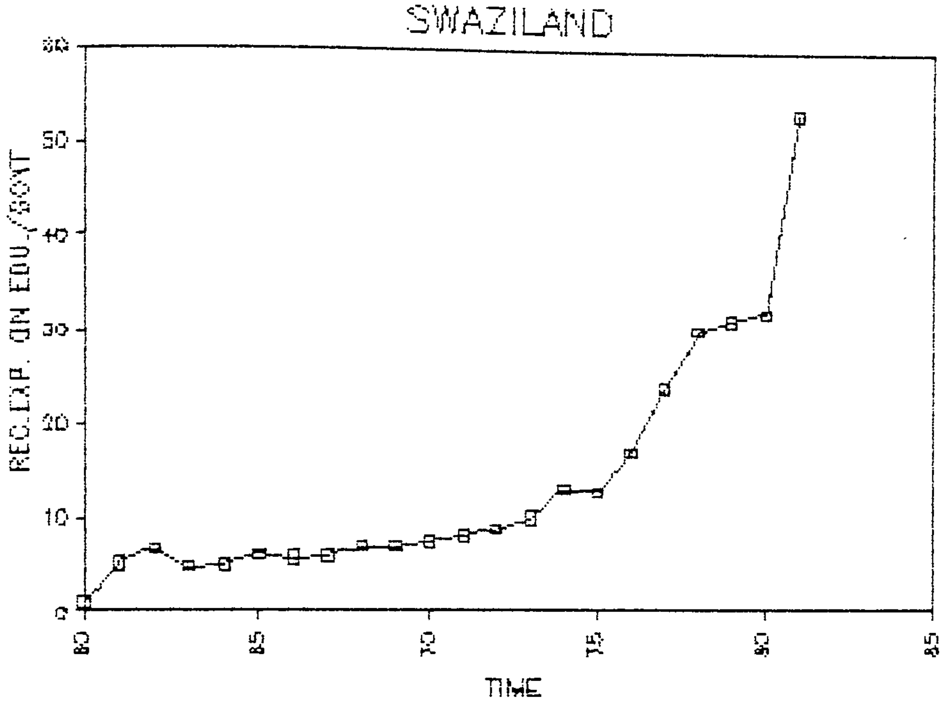


FIGURE A3-36: RECURRENT EXPENDITURE ON EDUCATION BY GOVERNMENT.

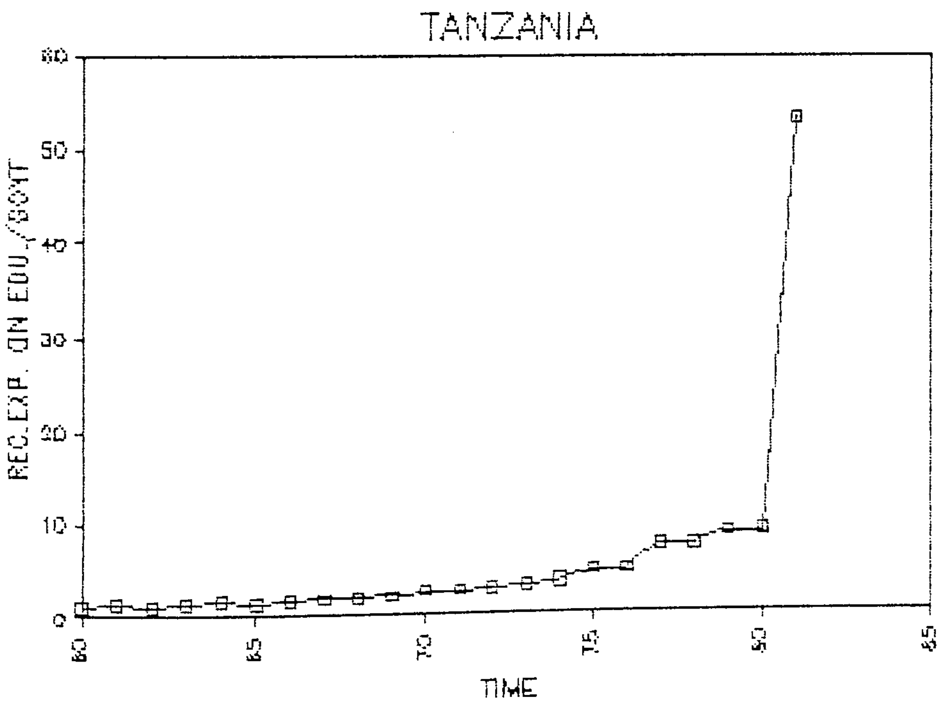


FIGURE A3-37: CAPITAL EXPENDITURE ON EDUCATION BY GOVERNMENT.

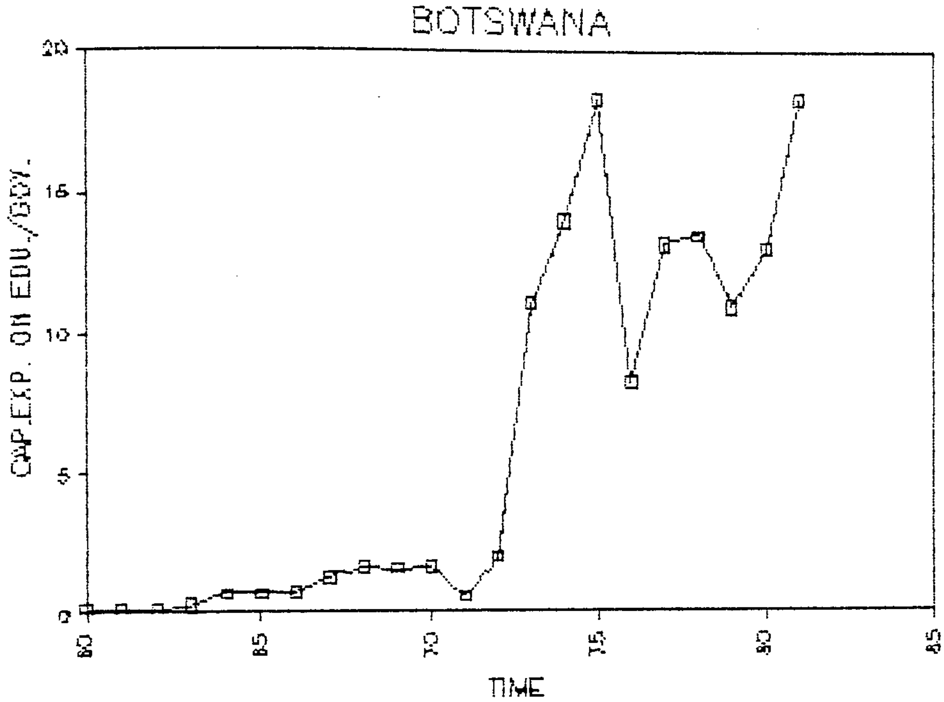


FIGURE A3-38: CAPITAL EXPENDITURE ON EDUCATION BY GOVERNMENT.

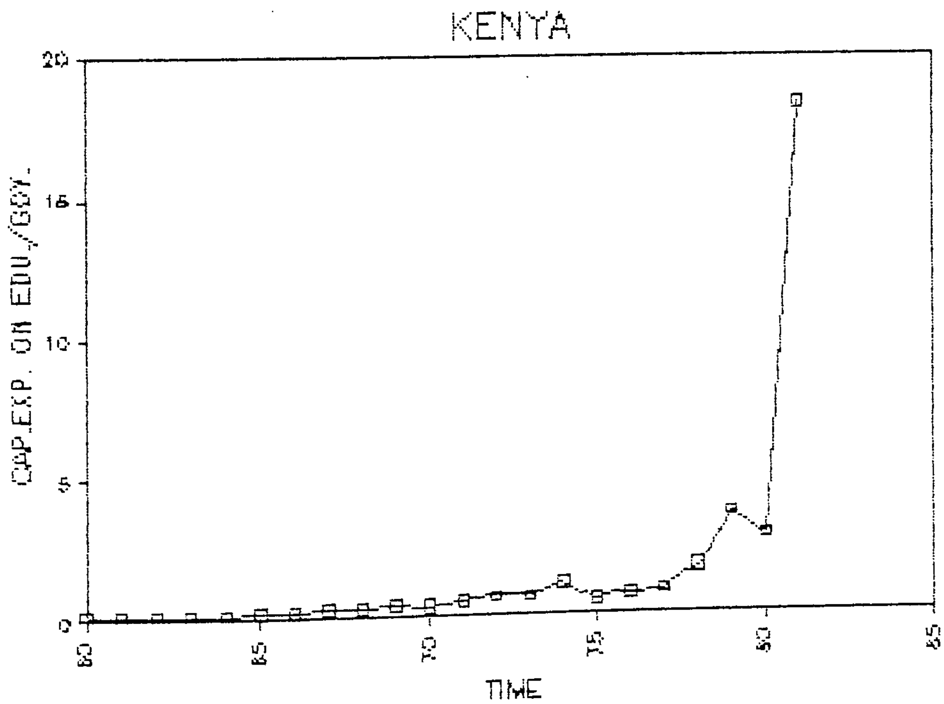


FIGURE A3-39: CAPITAL EXPENDITURE ON EDUCATION BY GOVERNMENT.

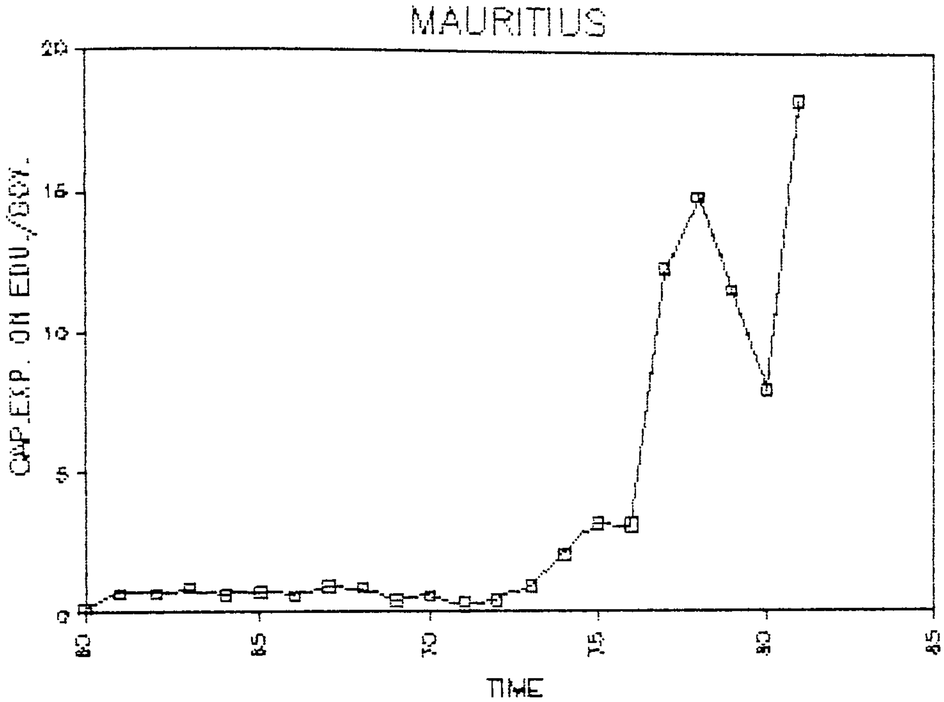


FIGURE A3-40: CAPITAL EXPENDITURE ON EDUCATION BY GOVERNMENT.

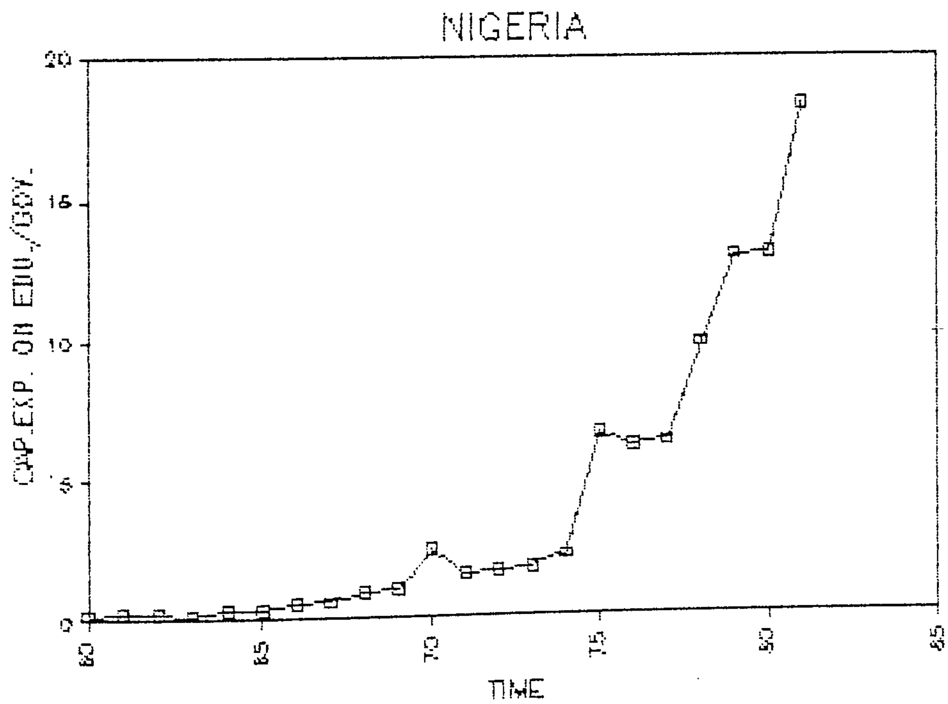


FIGURE A3-41: CAPITAL EXPENDITURE ON EDUCATION BY GOVERNMENT.

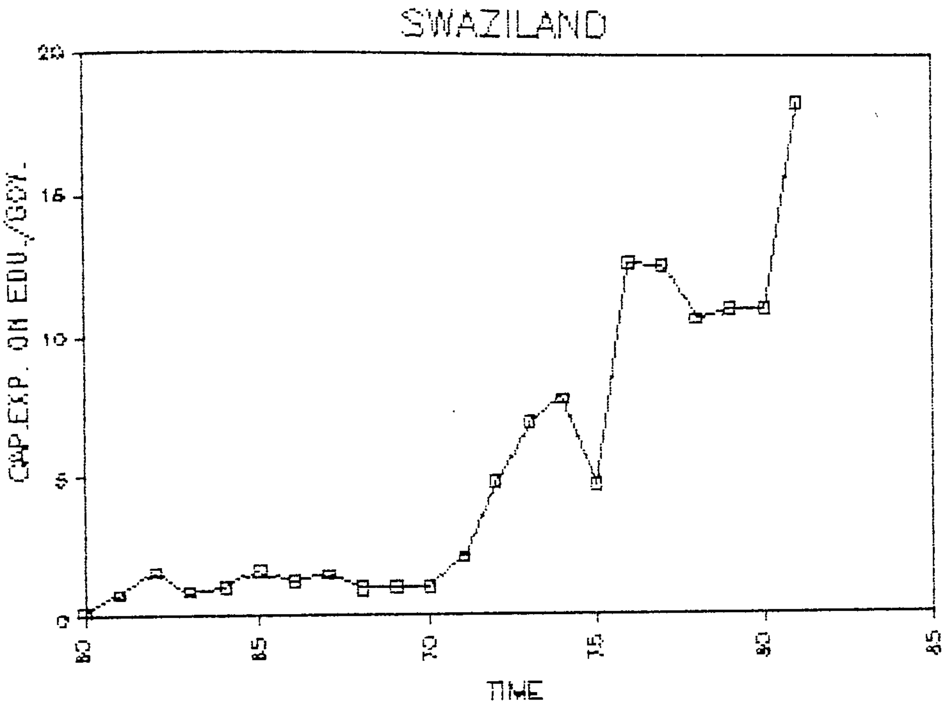


FIGURE A3-42: CAPITAL EXPENDITURE ON EDUCATION BY GOVERNMENT.

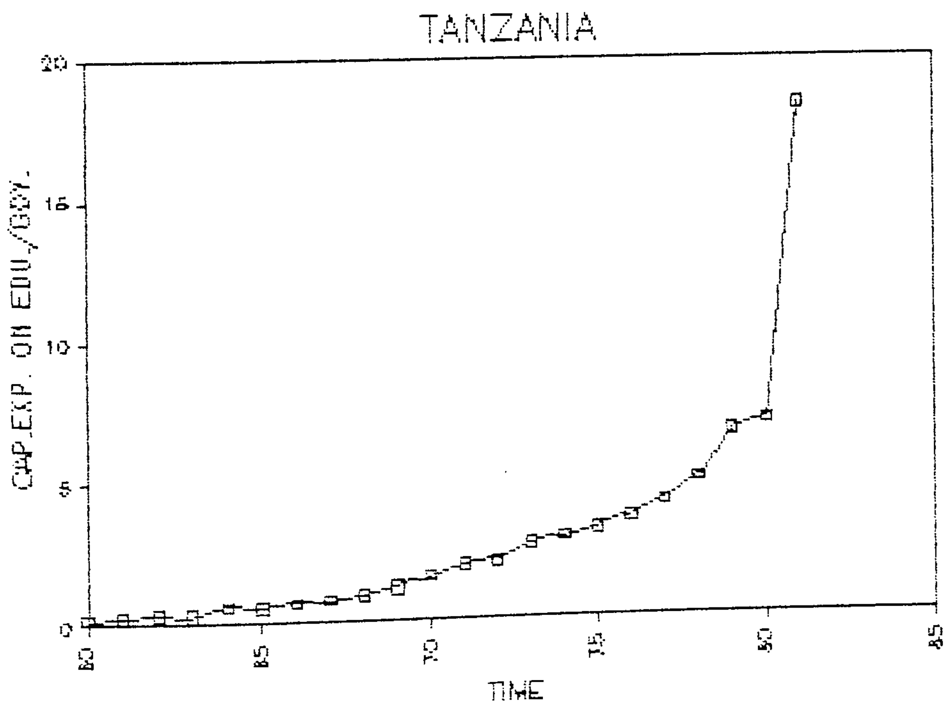


FIGURE A3-43: TOTAL EXPENDITURE ON HEALTH BY GOVERNMENT.
(1961 - 1980)

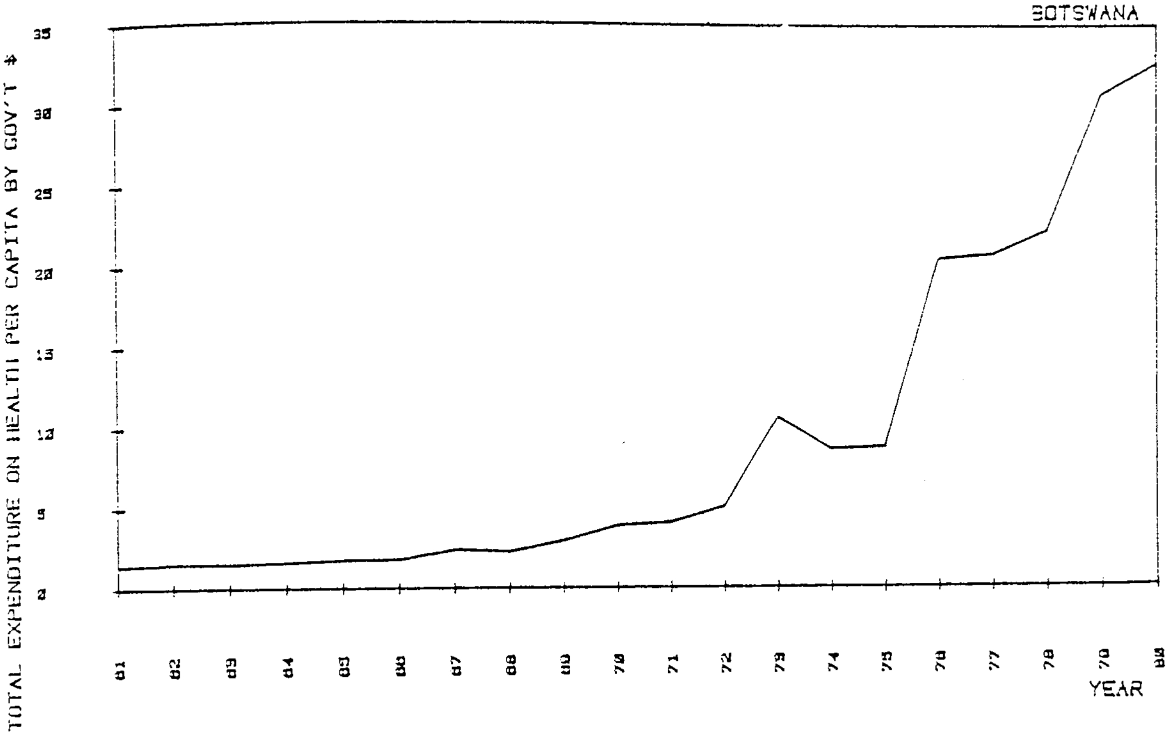
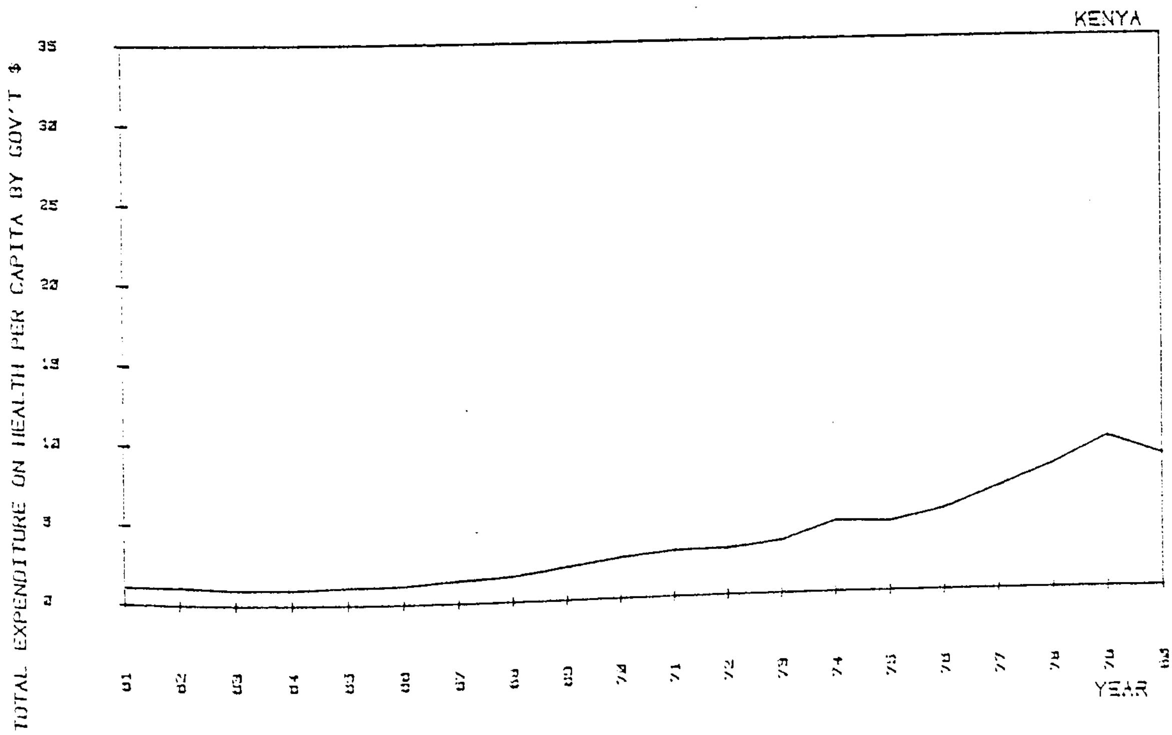


FIGURE A3-44: TOTAL EXPENDITURE ON HEALTH BY GOVERNMENT.
(1961 - 1980)



Continued ...

FIGURE A3-45: TOTAL EXPENDITURE ON HEALTH BY GOVERNMENT.
(1961 - 1980)

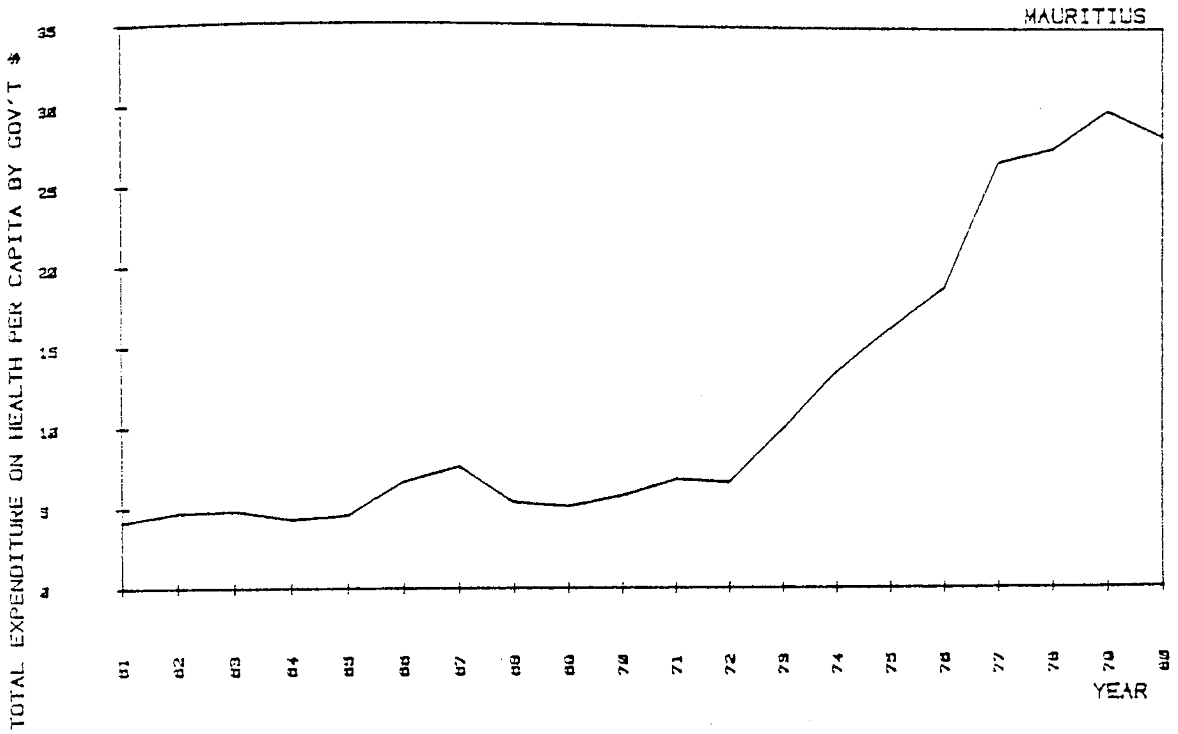
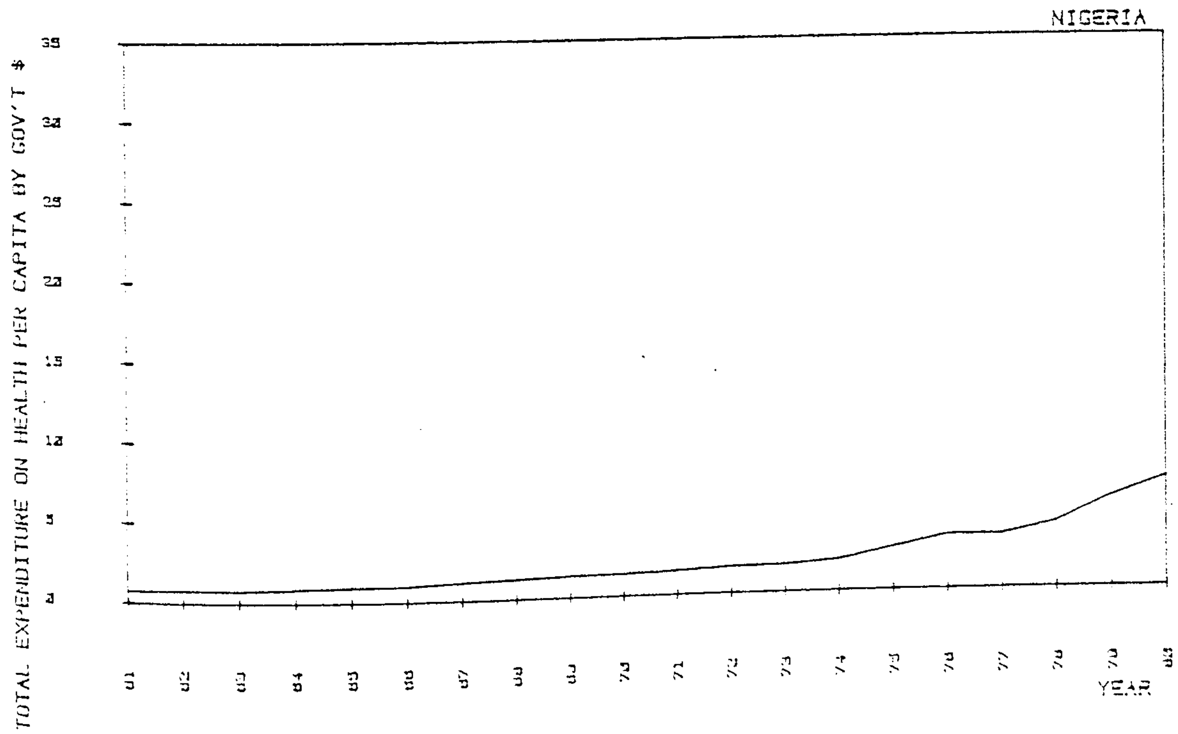


FIGURE A3-46: TOTAL EXPENDITURE ON HEALTH BY GOVERNMENT.
(1961 - 1980)



Continued ...

FIGURE A3-47: TOTAL EXPENDITURE ON HEALTH BY GOVERNMENT.
(1961 - 1980)

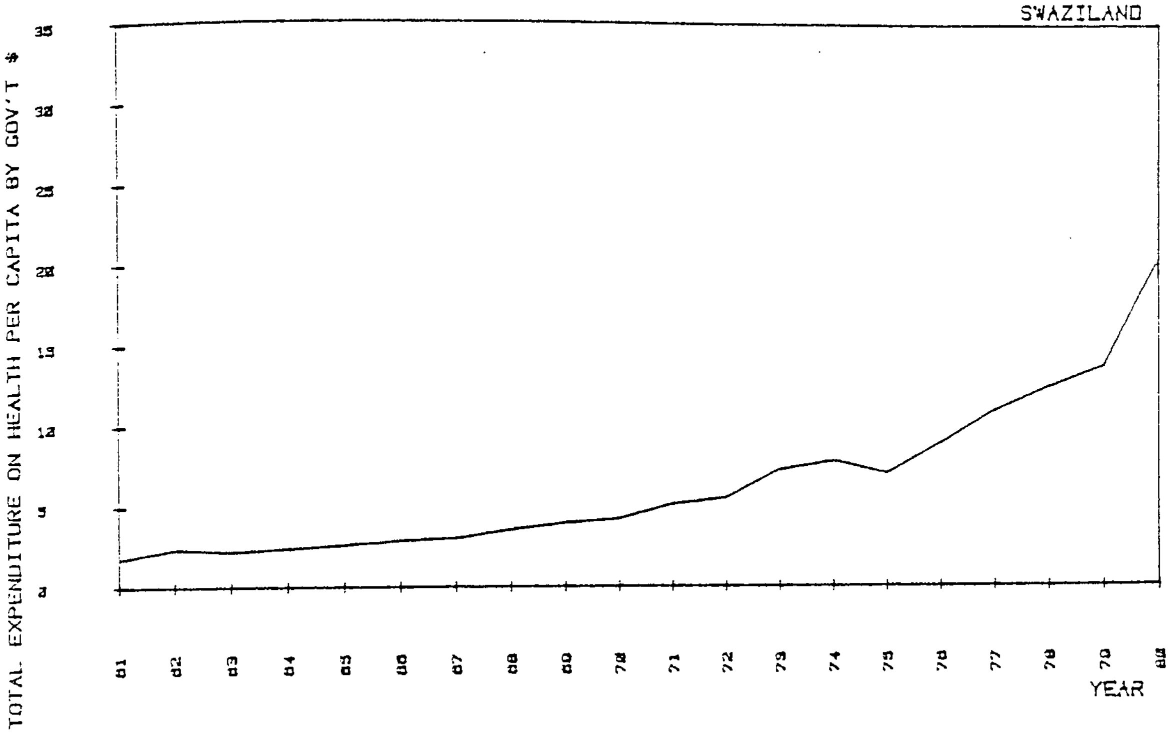
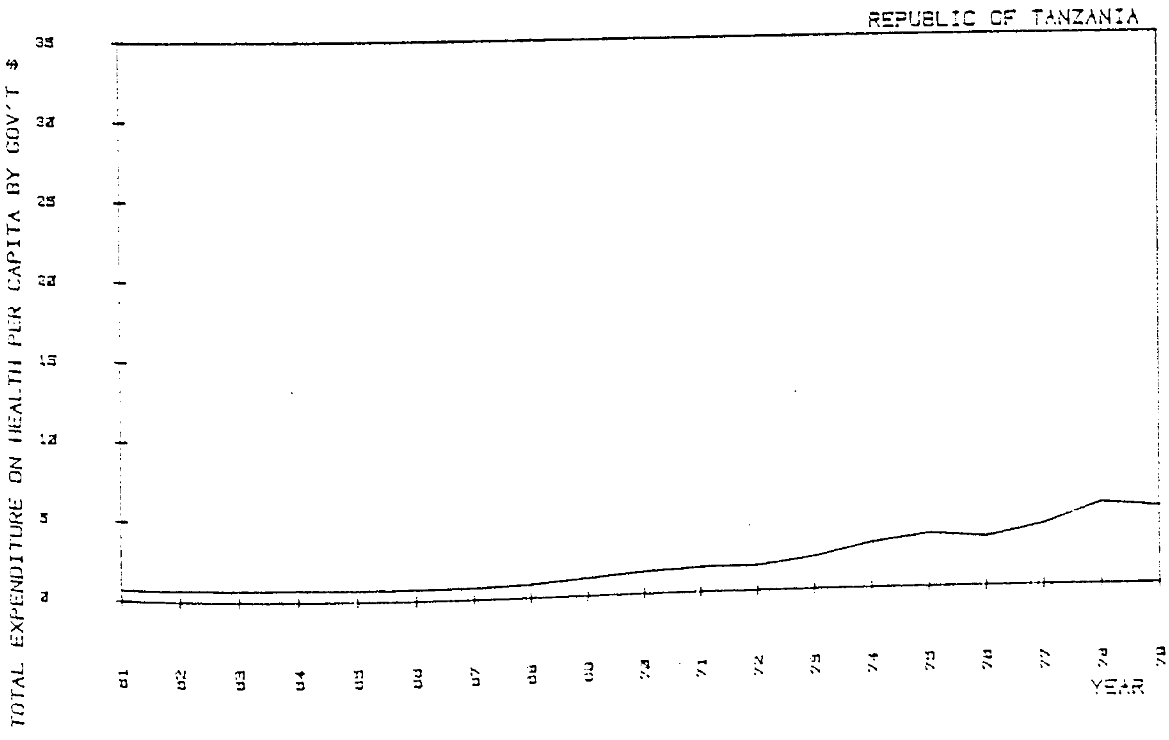


FIGURE A3-48: TOTAL EXPENDITURE ON HEALTH BY GOVERNMENT.
(1961 - 1979)



Continued ...

FIGURE A3-49: RECURRENT EXPENDITURE ON HEALTH BY GOVERNMENT.

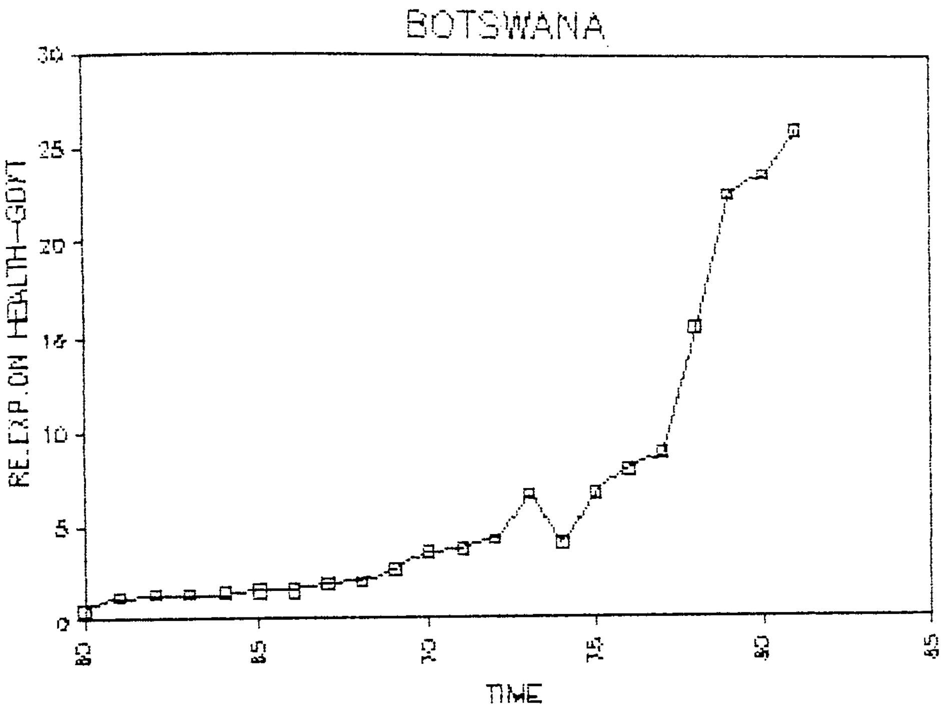


FIGURE A3-50: RECURRENT EXPENDITURE ON HEALTH BY GOVERNMENT.

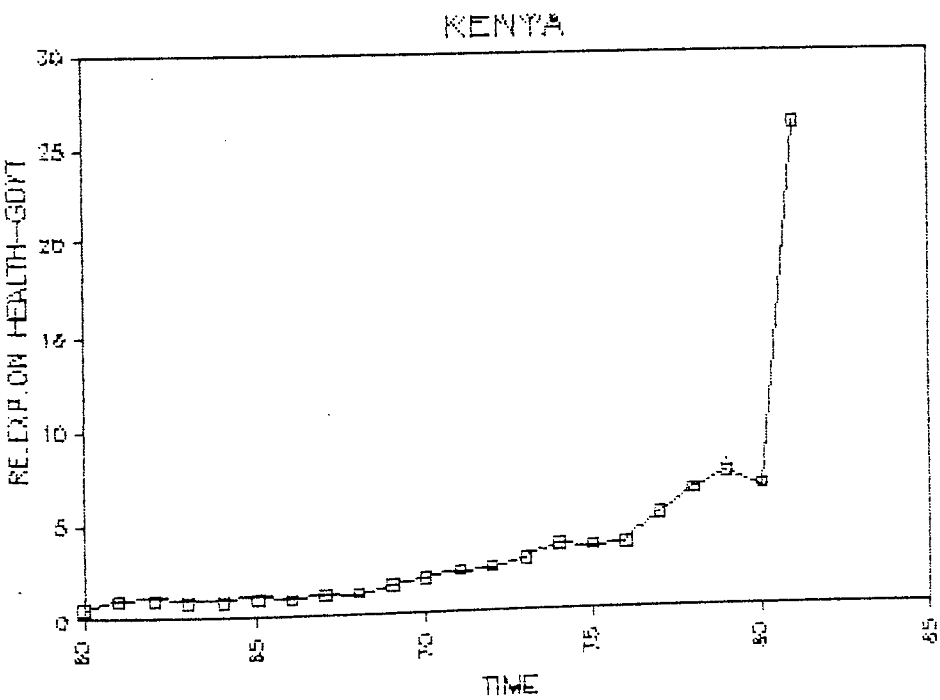


FIGURE A3-51: RECURRENT EXPENDITURE ON HEALTH BY GOVERNMENT.

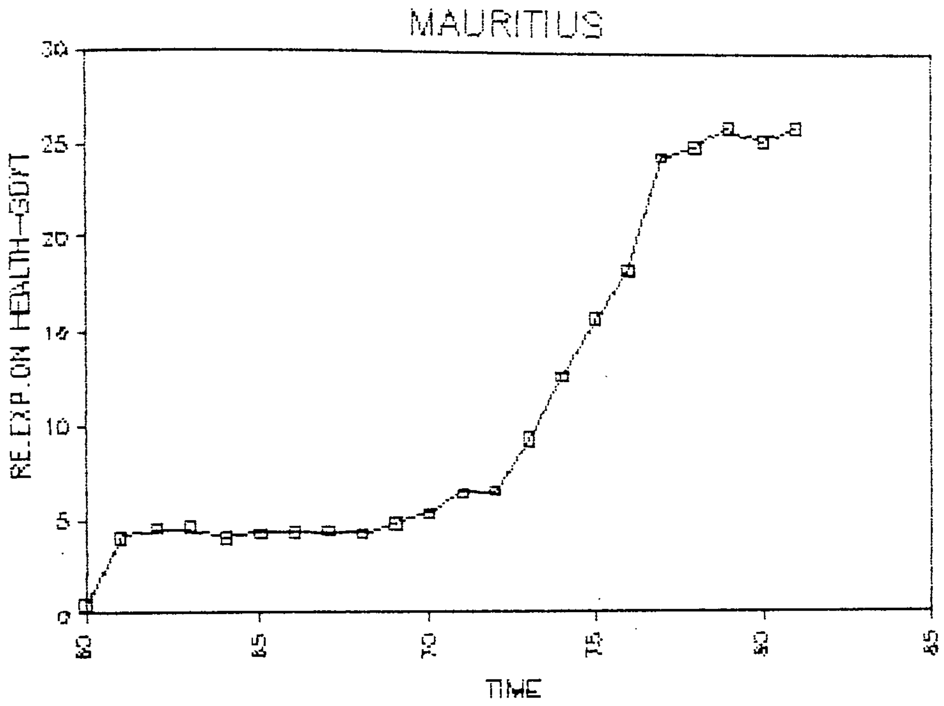


FIGURE A3-52: RECURRENT EXPENDITURE ON HEALTH BY GOVERNMENT.

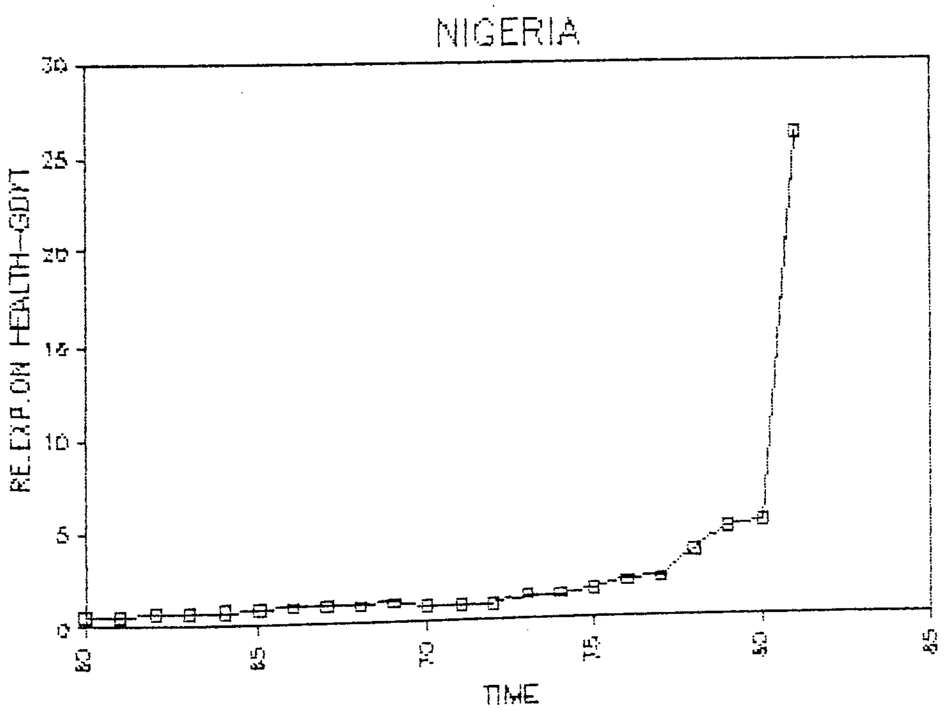


FIGURE A3-53: RECURRENT EXPENDITURE ON HEALTH BY GOVERNMENT.

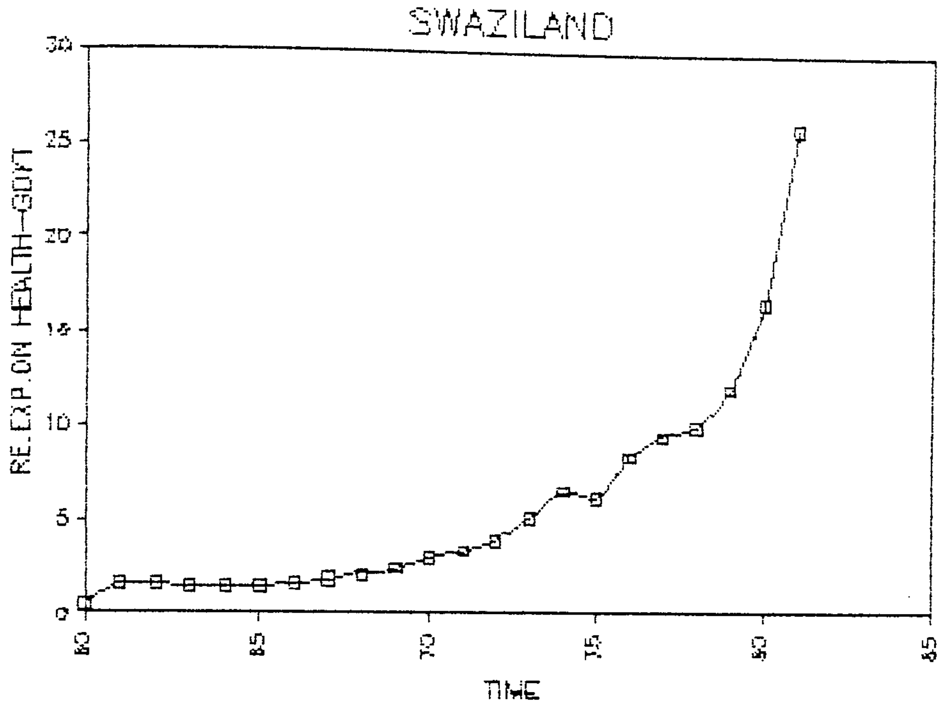


FIGURE A3-54: RECURRENT EXPENDITURE ON HEALTH BY GOVERNMENT.

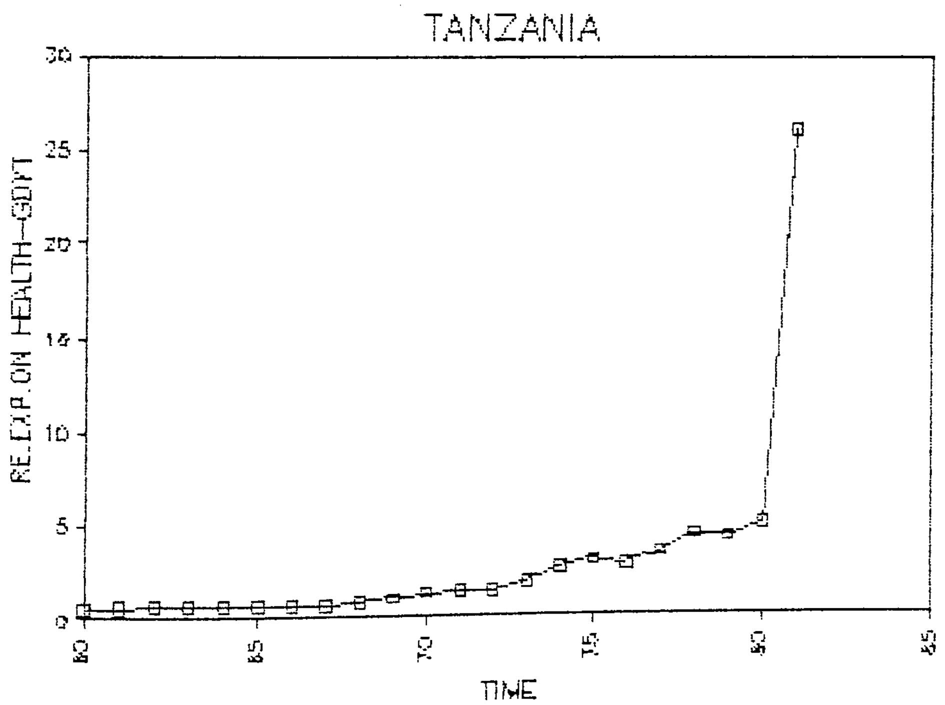


FIGURE A3-55: CAPITAL EXPENDITURE ON HEALTH BY GOVERNMENT.

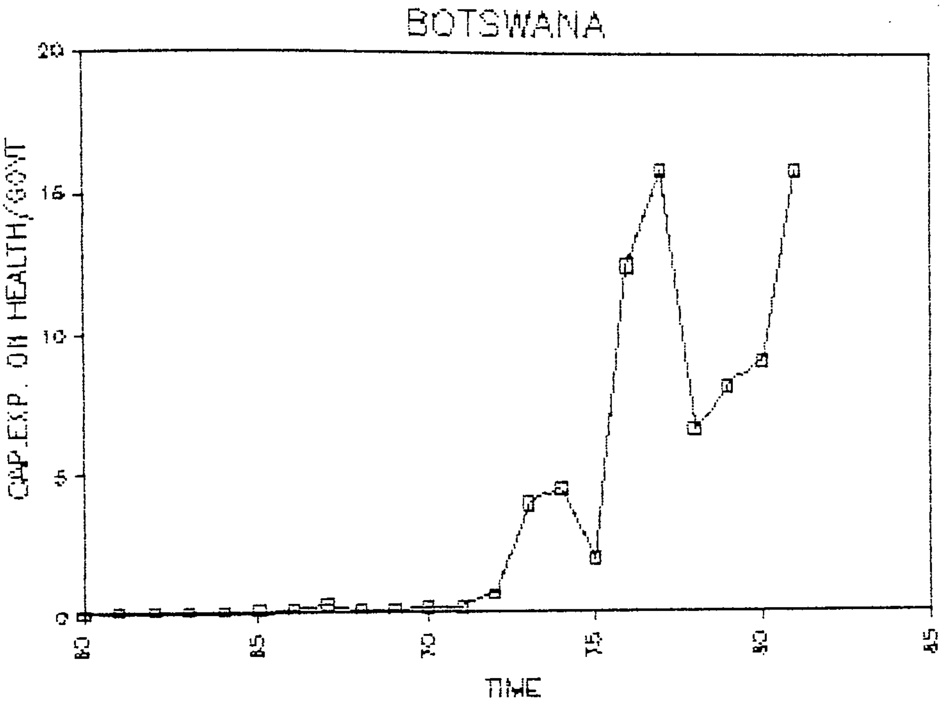


FIGURE A3-56: CAPITAL EXPENDITURE ON HEALTH BY GOVERNMENT.

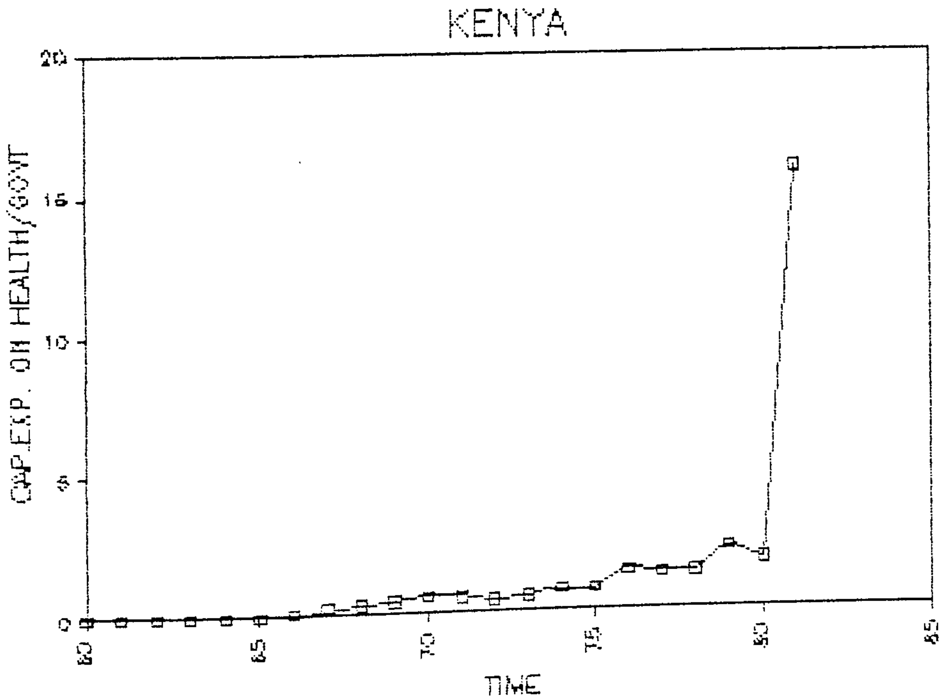


FIGURE A3-57: CAPITAL EXPENDITURE ON HEALTH BY GOVERNMENT

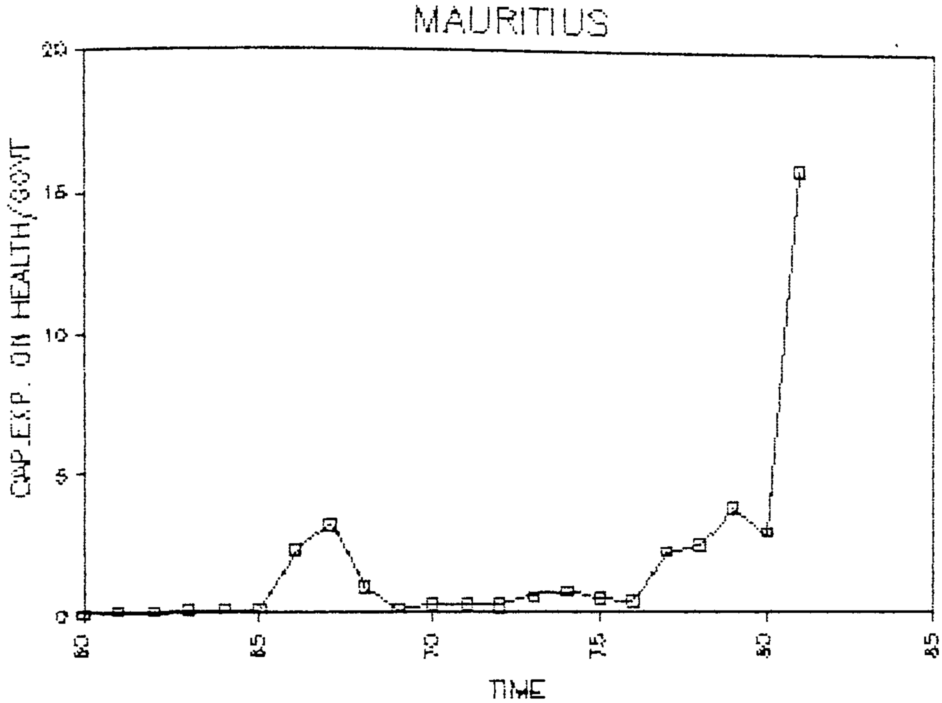


FIGURE A3-58: CAPITAL EXPENDITURE ON HEALTH BY GOVERNMENT.

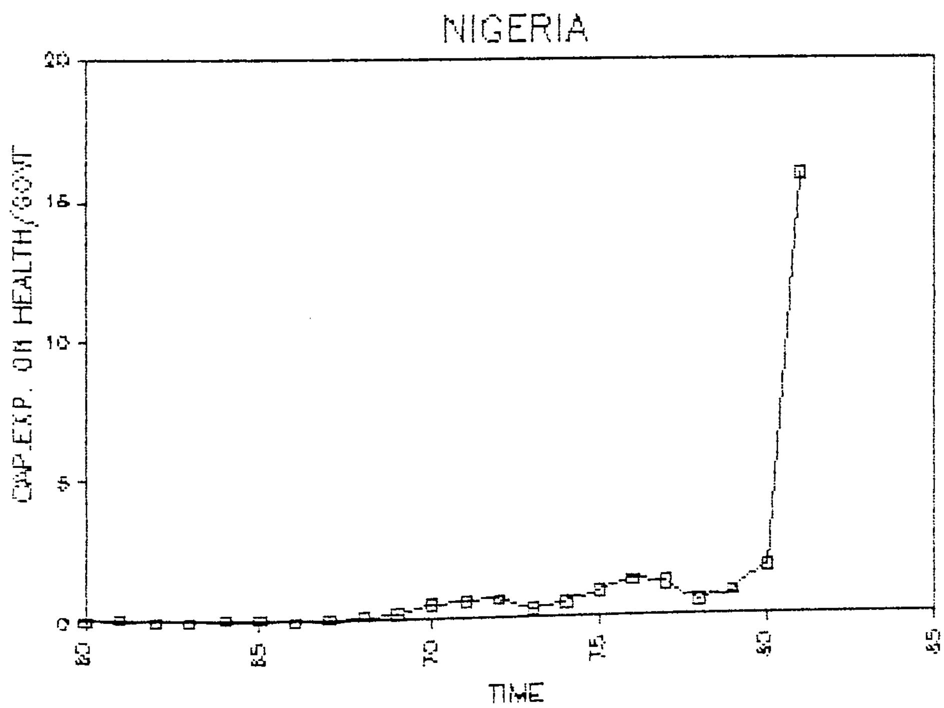


FIGURE A3-59: CAPITAL EXPENDITURE ON HEALTH BY GOVERNMENT.

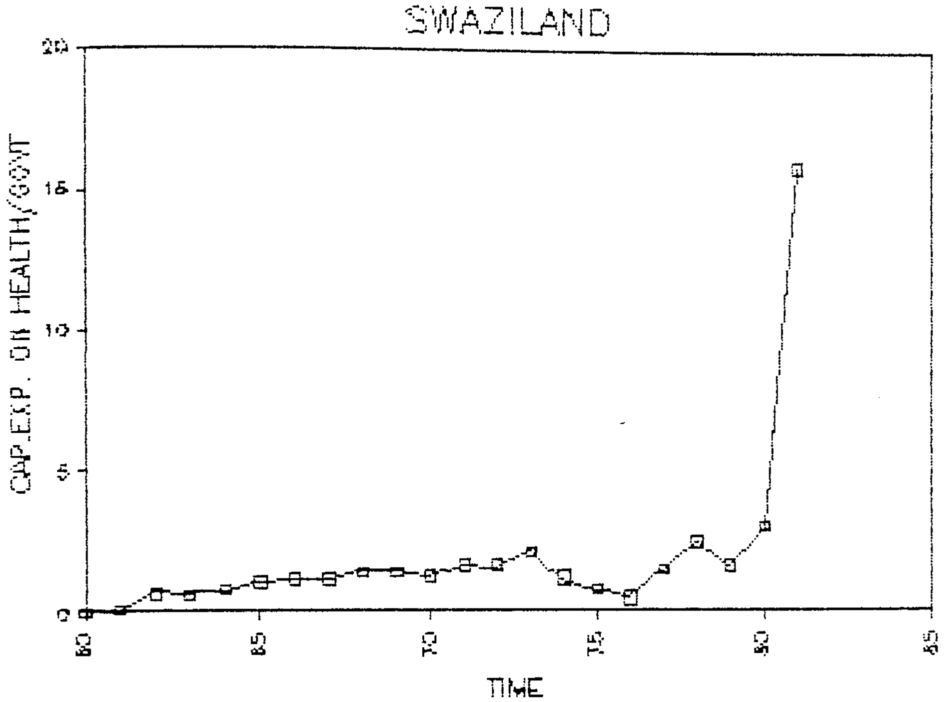


FIGURE A3-60: CAPITAL EXPENDITURE ON HEALTH BY GOVERNMENT.

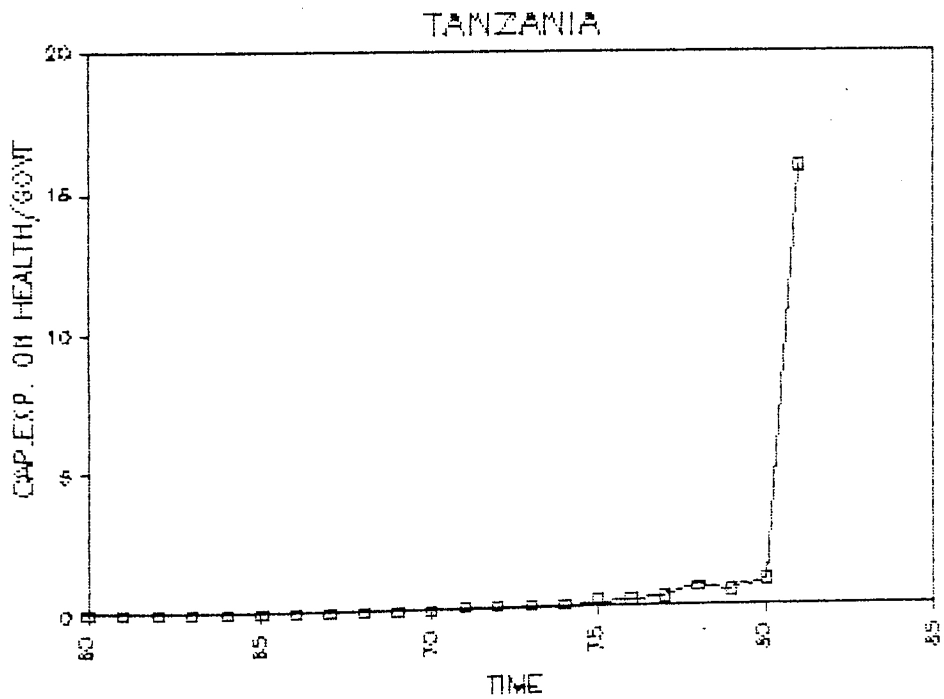
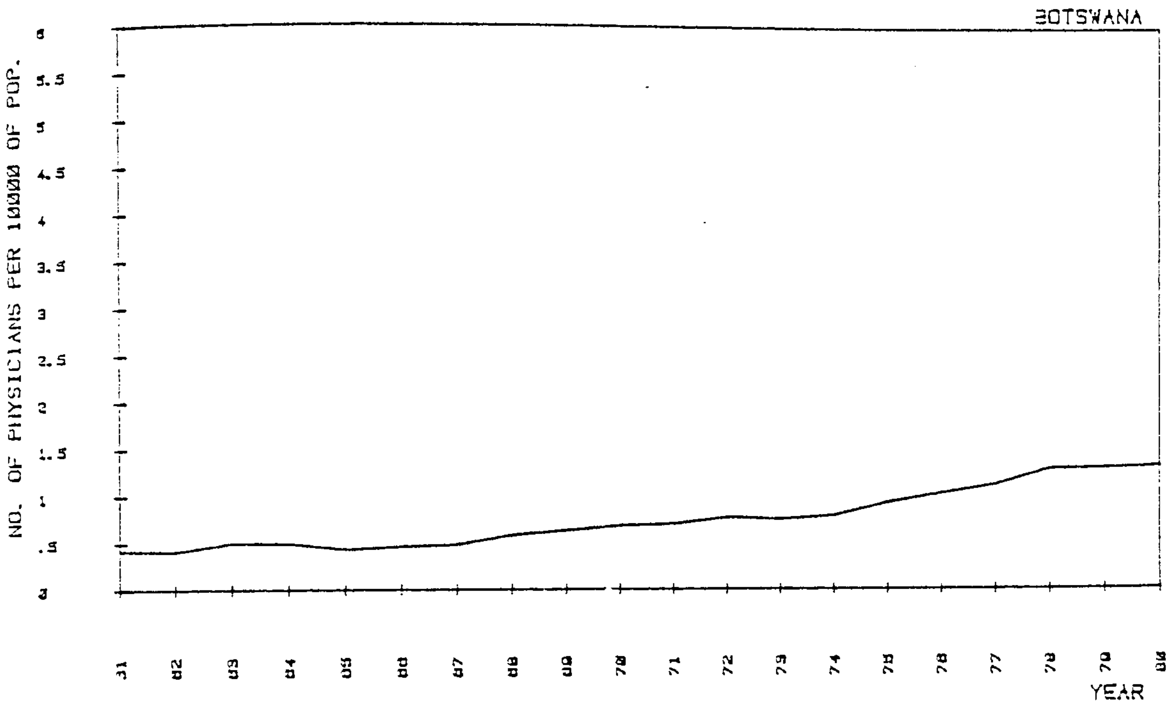


FIGURE A3-61: NUMBER OF PHYSICIANS PER 10,000 OF POPULATION. (1961 - 1980)



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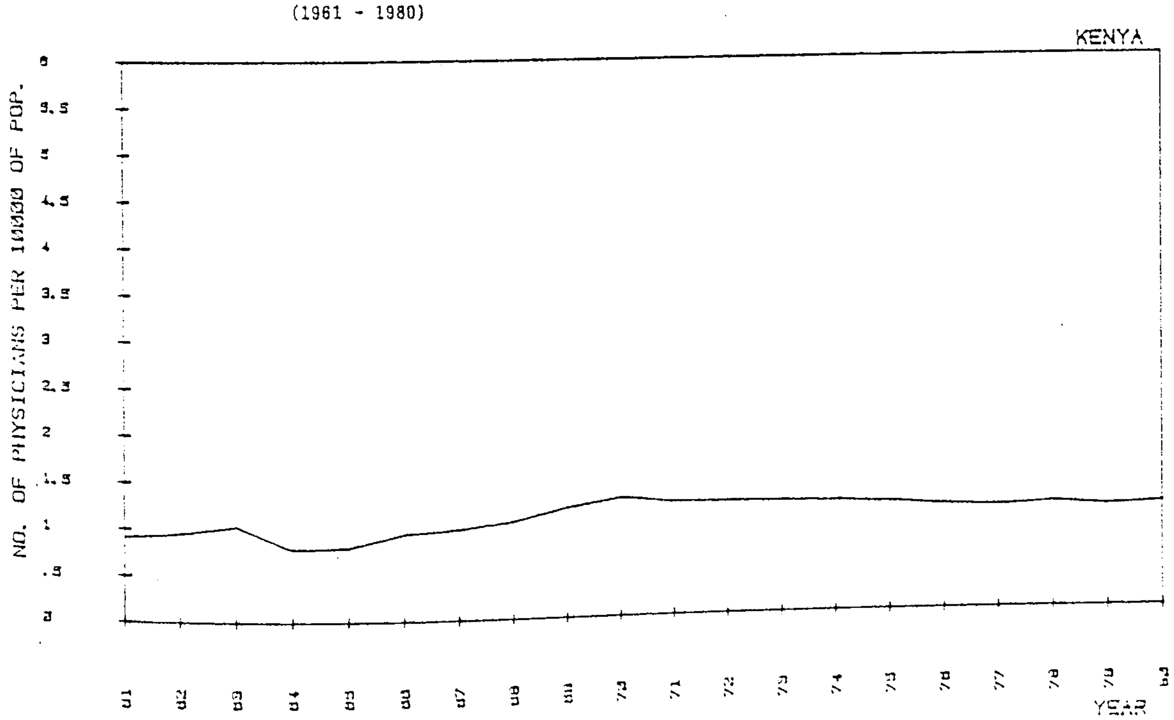

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(1961 - 1980)

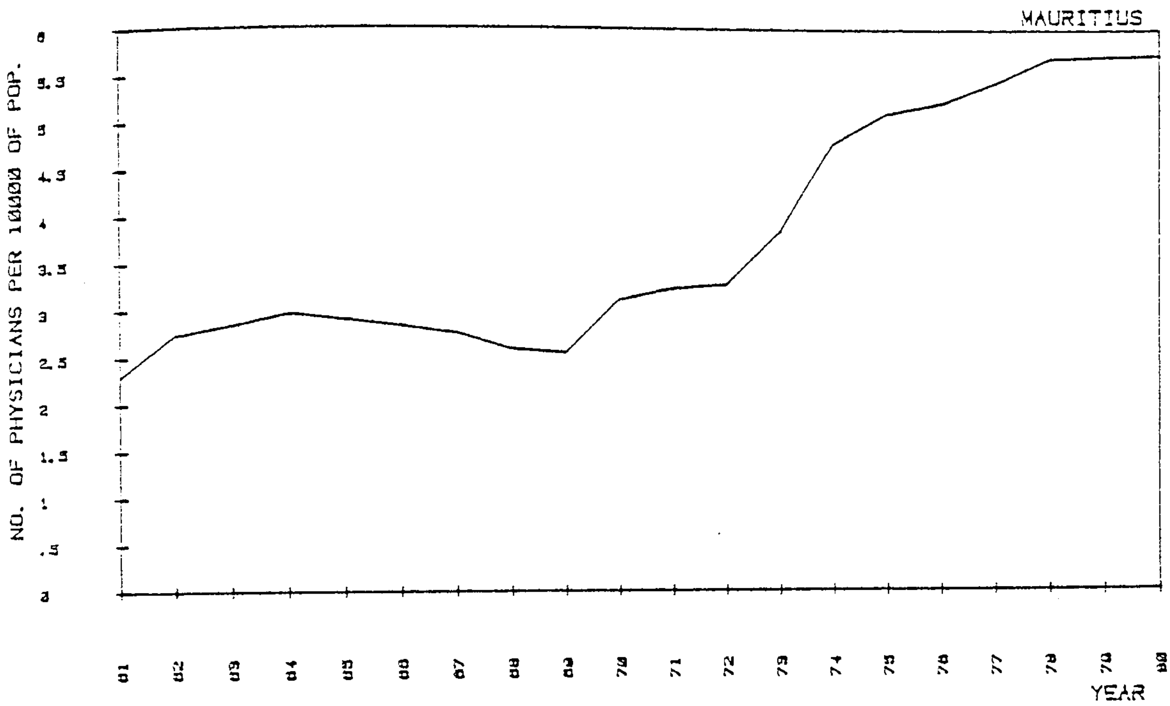
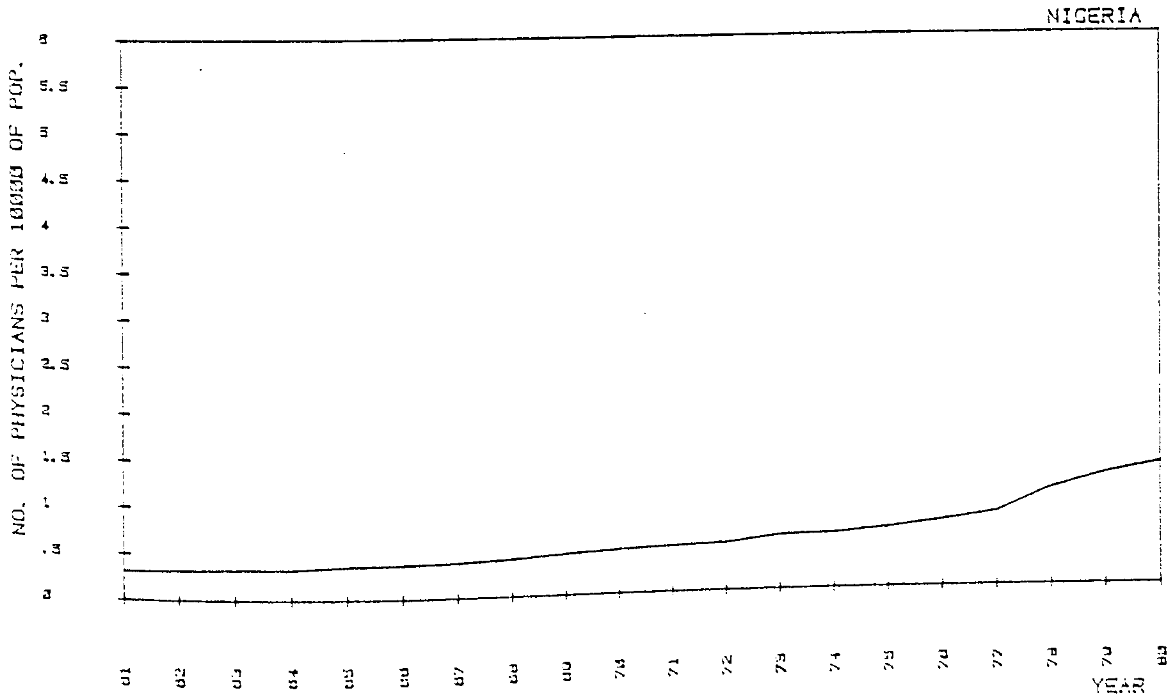


FIGURE A3-64: NUMBER OF PHYSICIANS PER 10,000 OF POPULATION.
(1961 - 1980)



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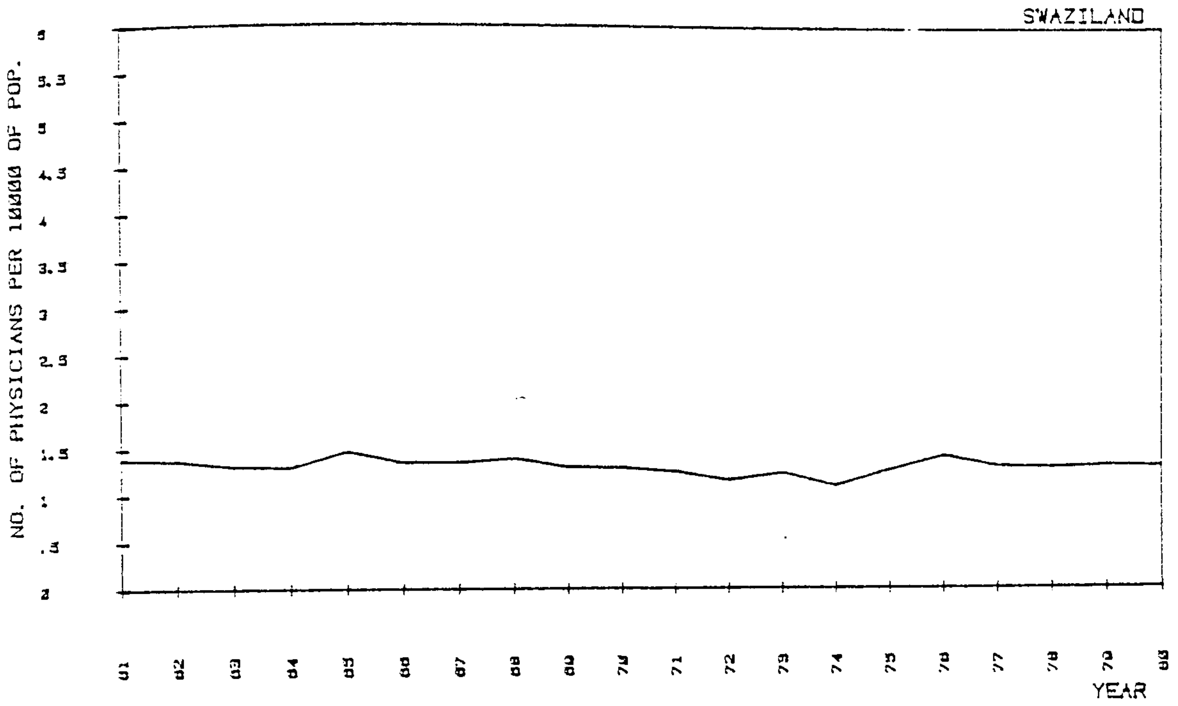

FIGURE A3-66: NUMBER OF PHYSICIANS PER 10,000 OF POPULATION. (1961 - 1980)

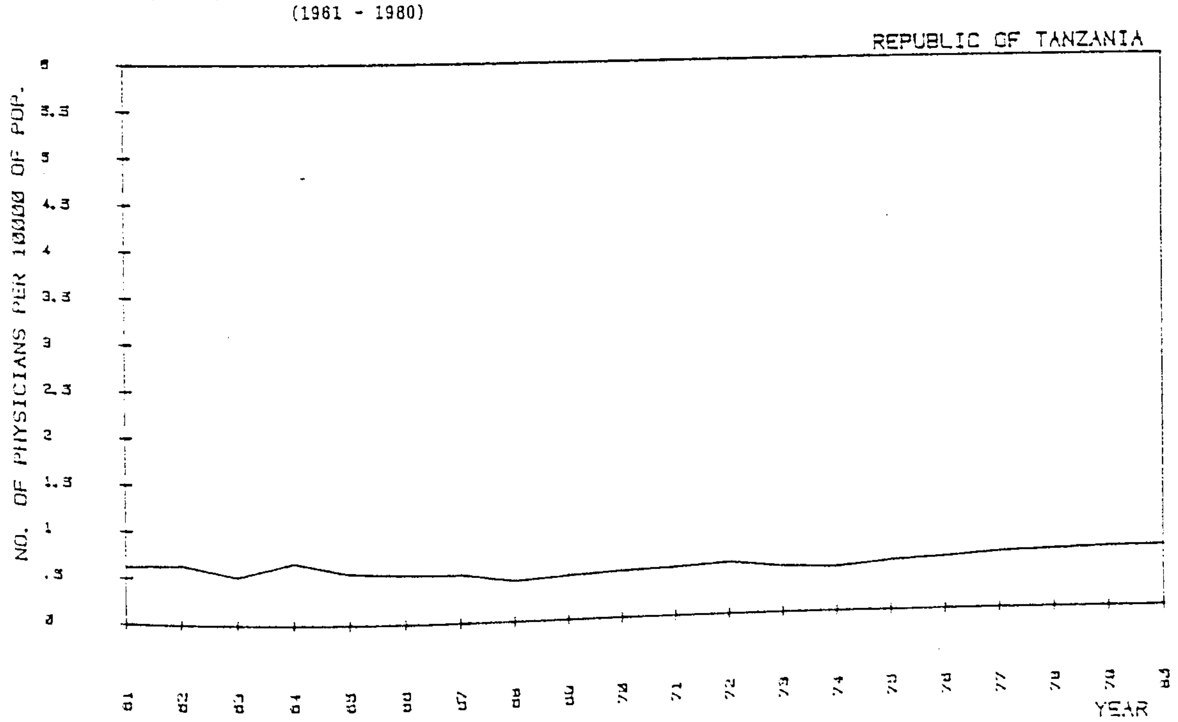

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FIGURE A3-67: NUMBER OF NURSES PER 1000 OF POPULATION.
(1961 - 1980)

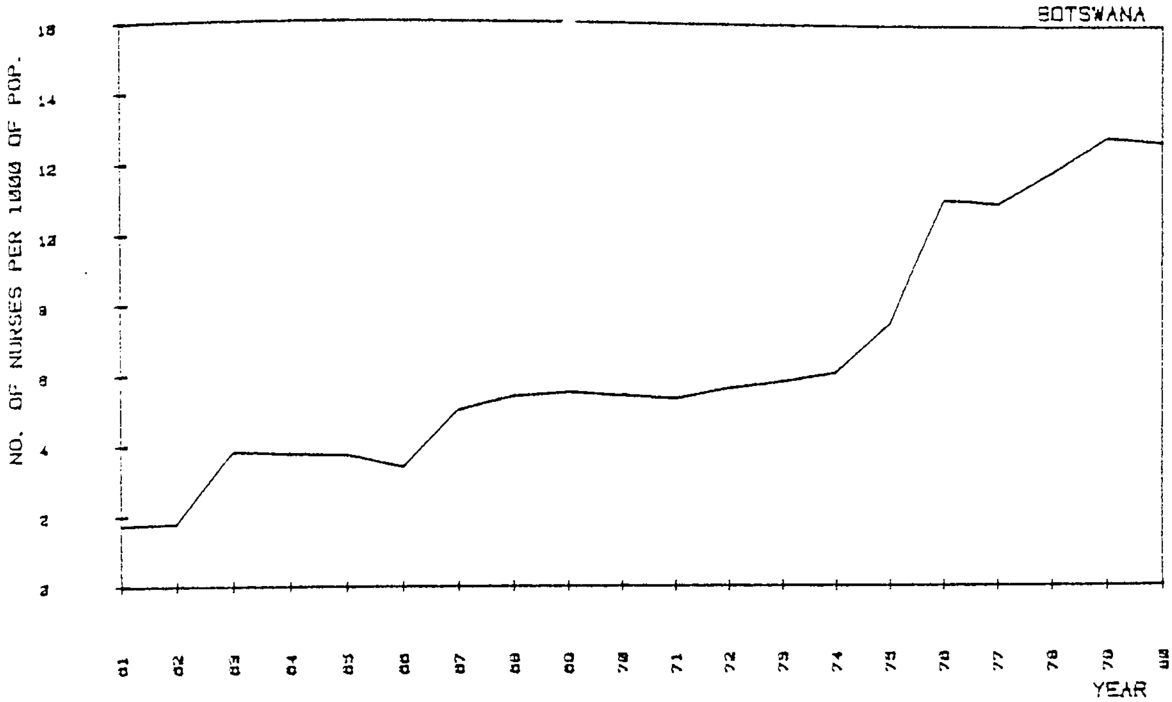

FIGURE A3-68: NUMBER OF NURSES PER 1000 OF POPULATION.
(1961 - 1980)

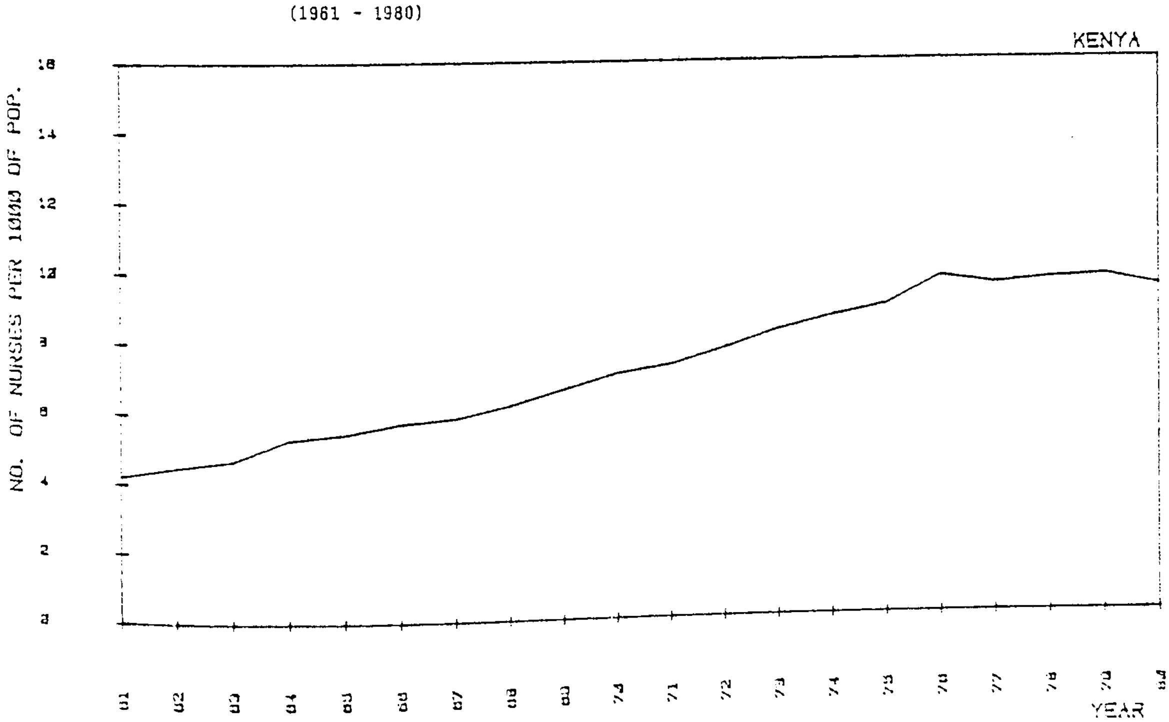

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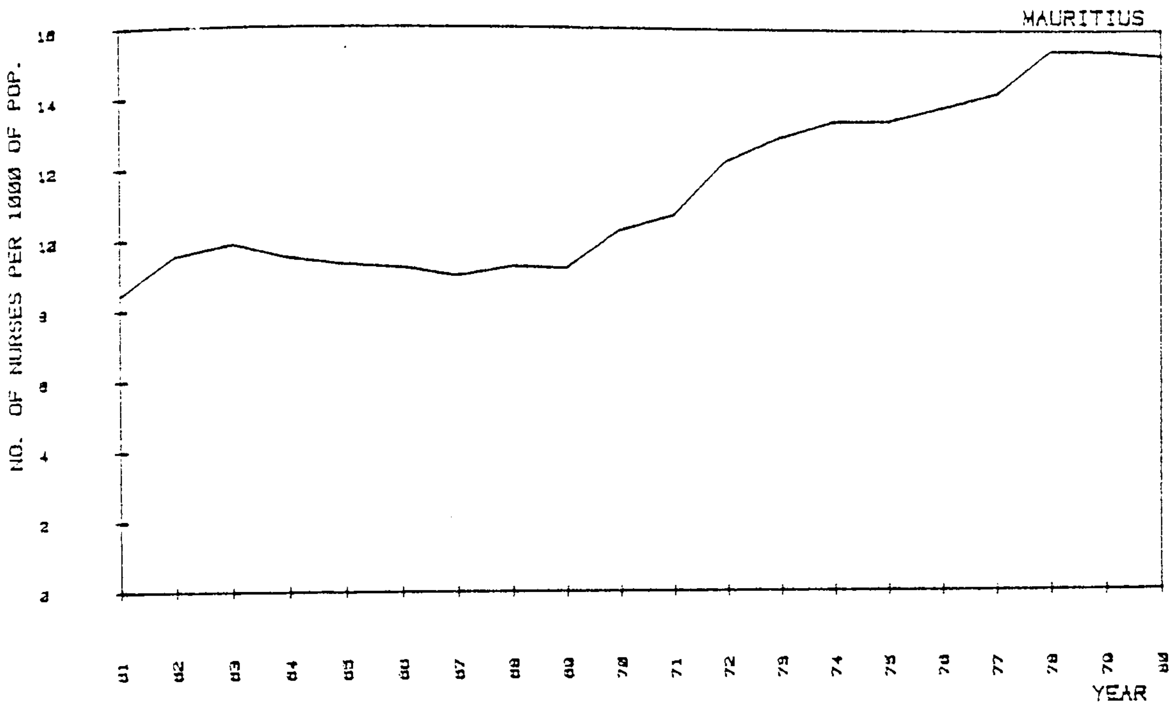
FIGURE A3-69: NUMBER OF NURSES PER 1000 OF POPULATION. (1961 - 1980)



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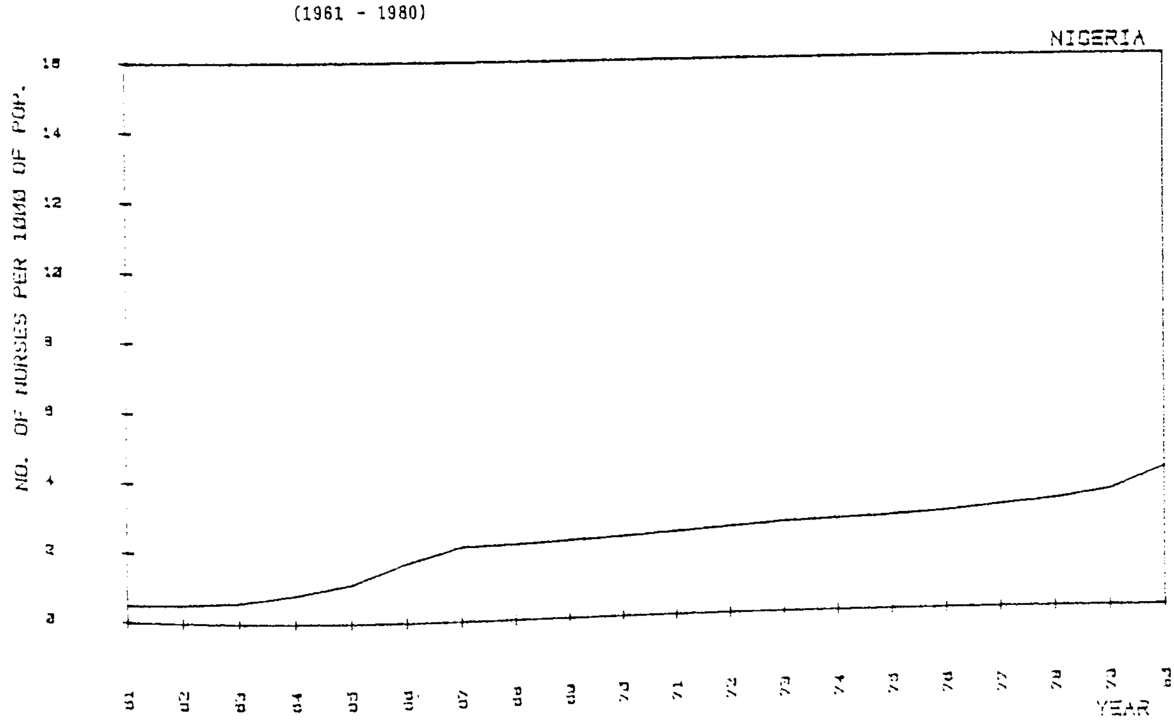

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(1961 - 1980)

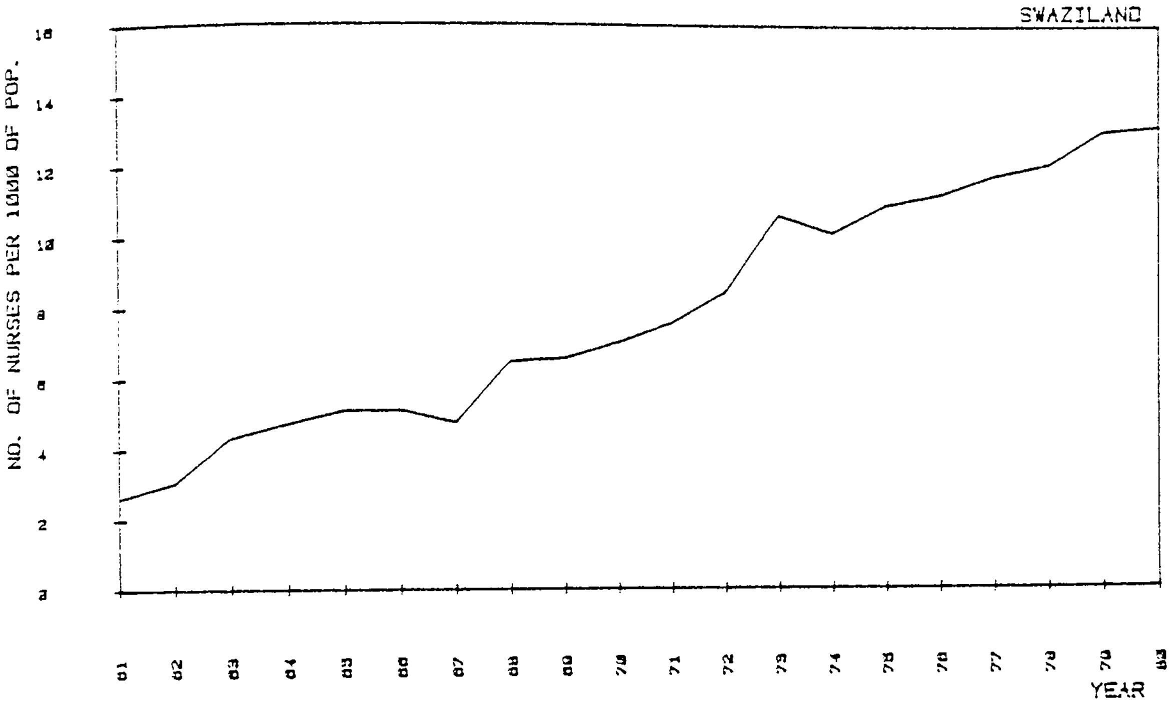

FIGURE A3-72: NUMBER OF NURSES PER 1000 OF POPULATION.
(1961 - 1980)

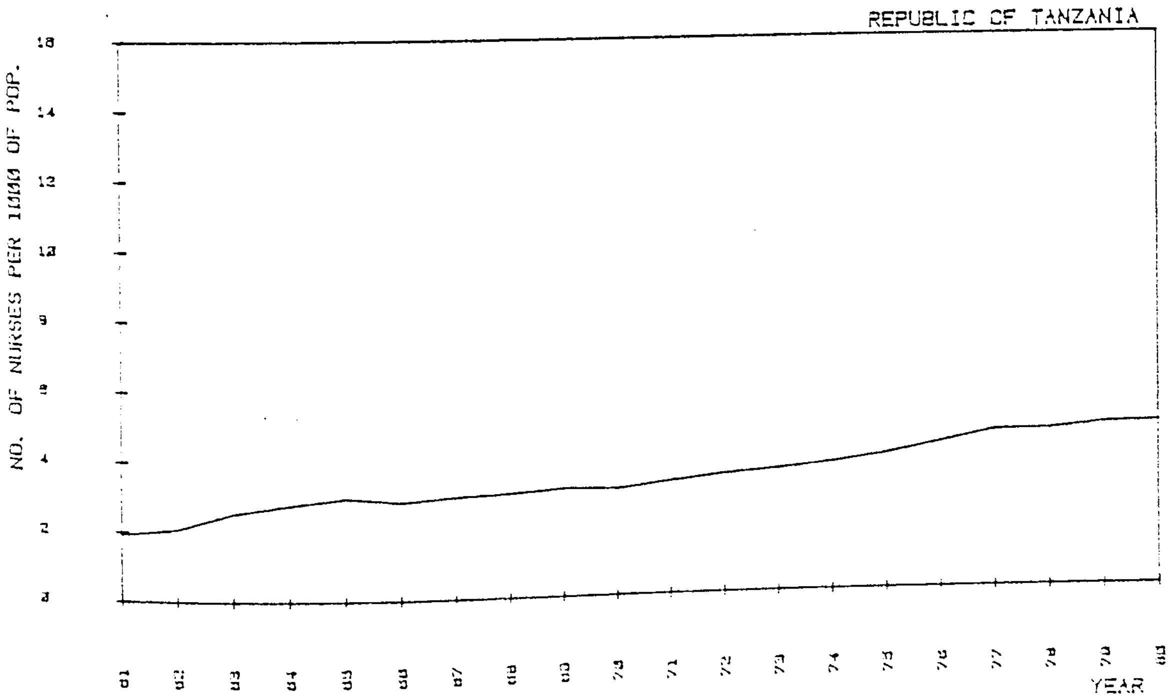

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FIGURE A3-73: NUMBER OF HOSPITAL BEDS PER 1000 OF POPULATION.
(1961 - 1979)

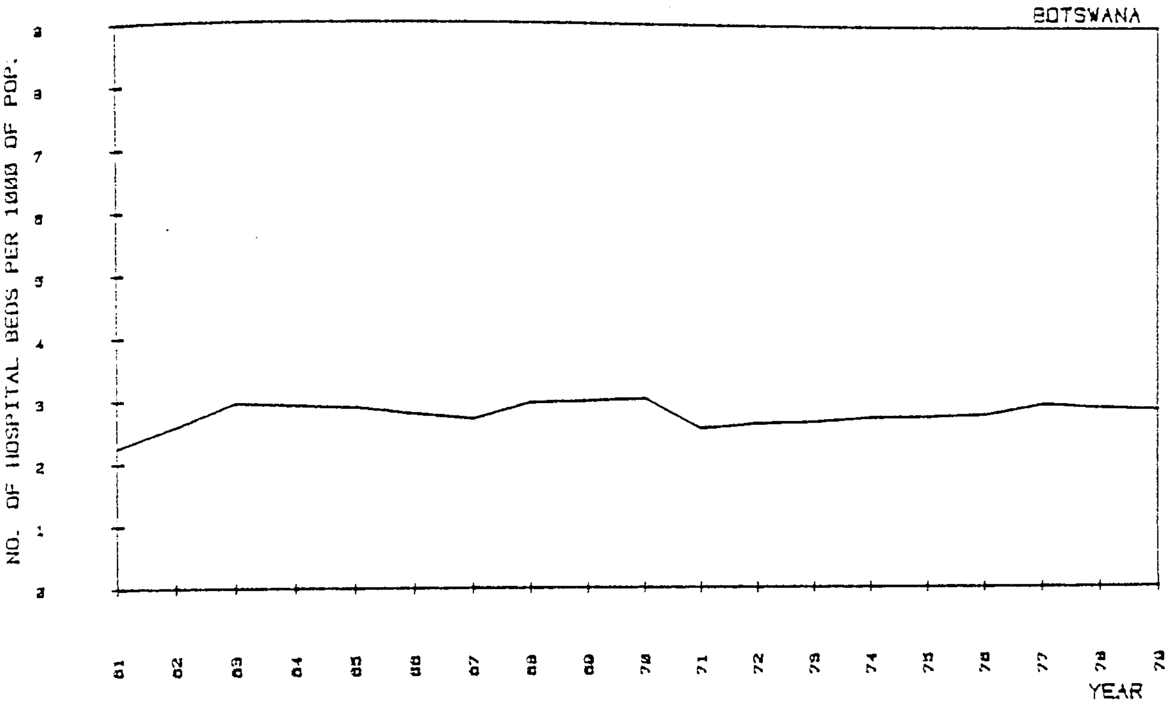

FIGURE A3-74: NUMBER OF HOSPITAL BEDS PER 1000 OF POPULATION.
(1961 - 1980)

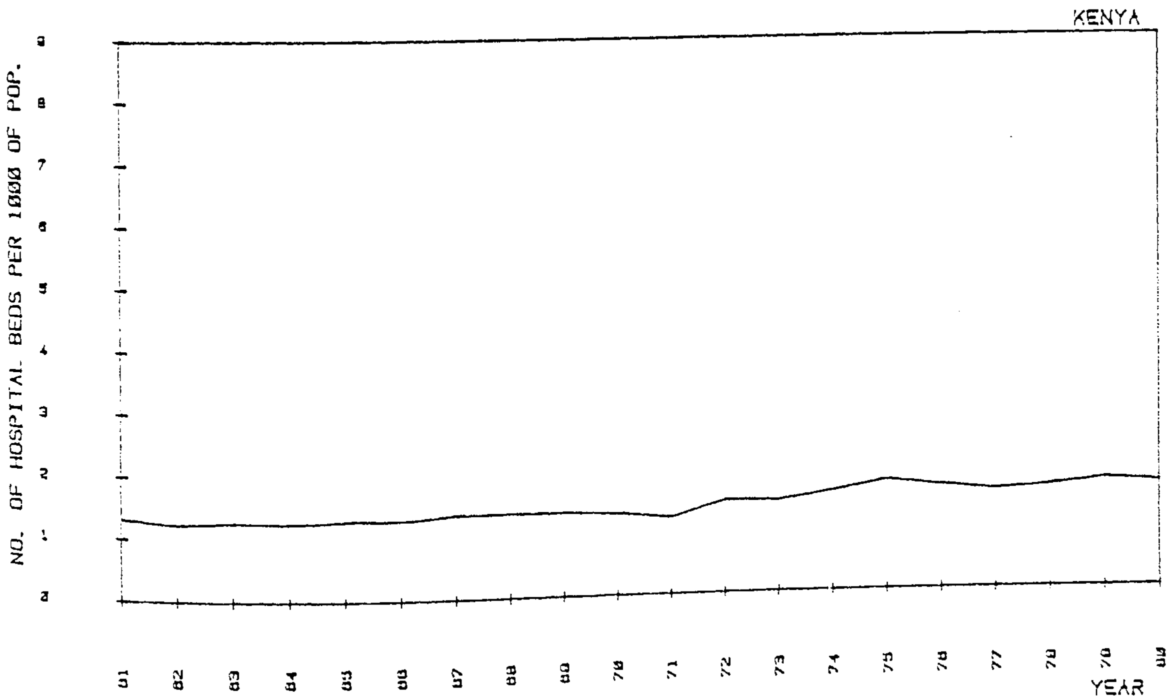

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FIGURE A3-75: NUMBER OF HOSPITAL BEDS PER 1000 OF POPULATION.
(1961 - 1980)

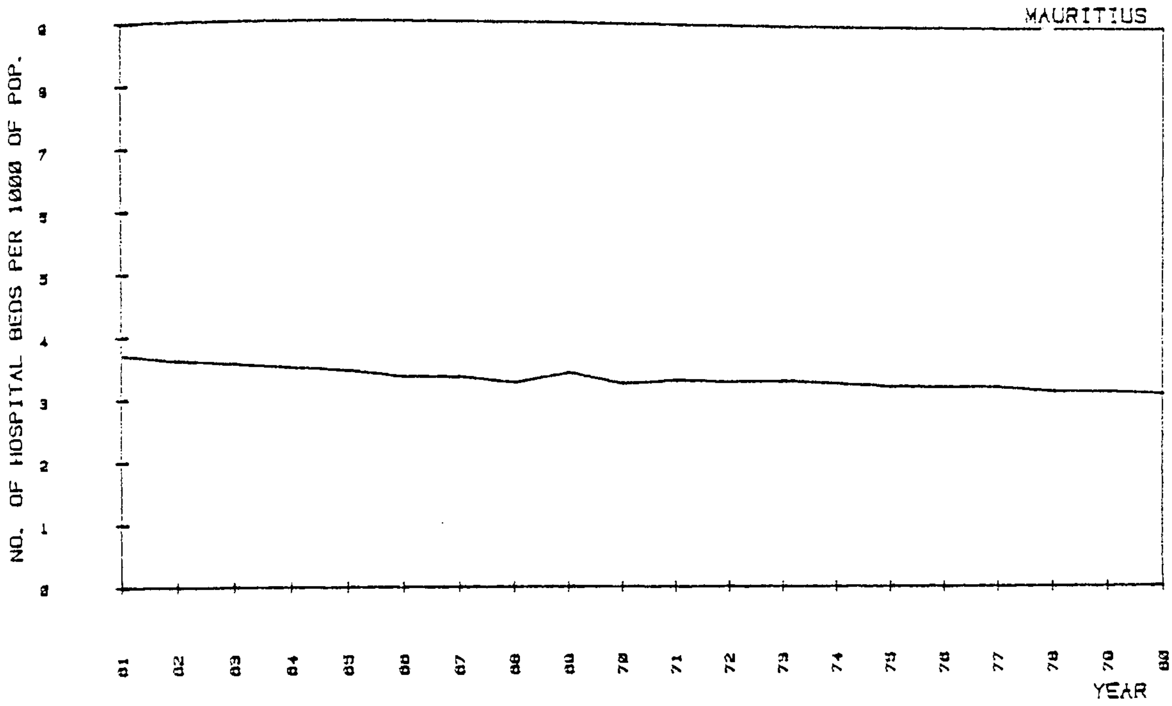

FIGURE A3-76: NUMBER OF HOSPITAL BEDS PER 1000 OF POPULATION.
(1961 - 1980)

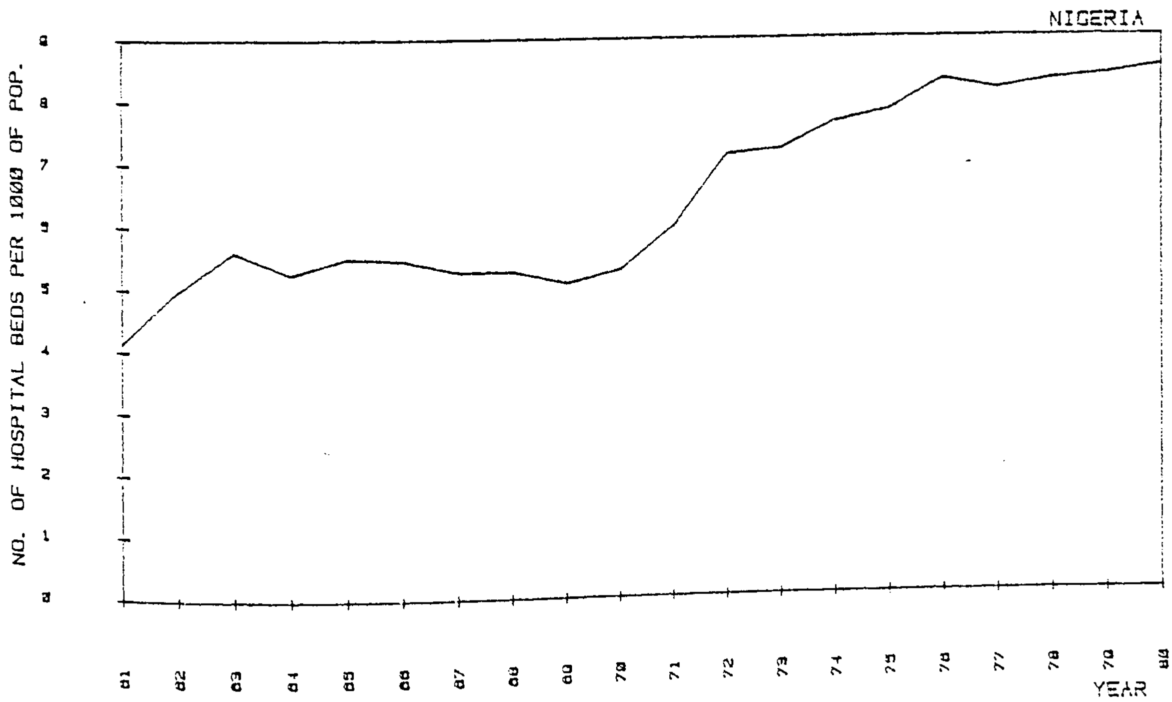

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FIGURE A3-77: NUMBER OF HOSPITAL BEDS PER 1000 OF POPULATION. (1961 - 1979)

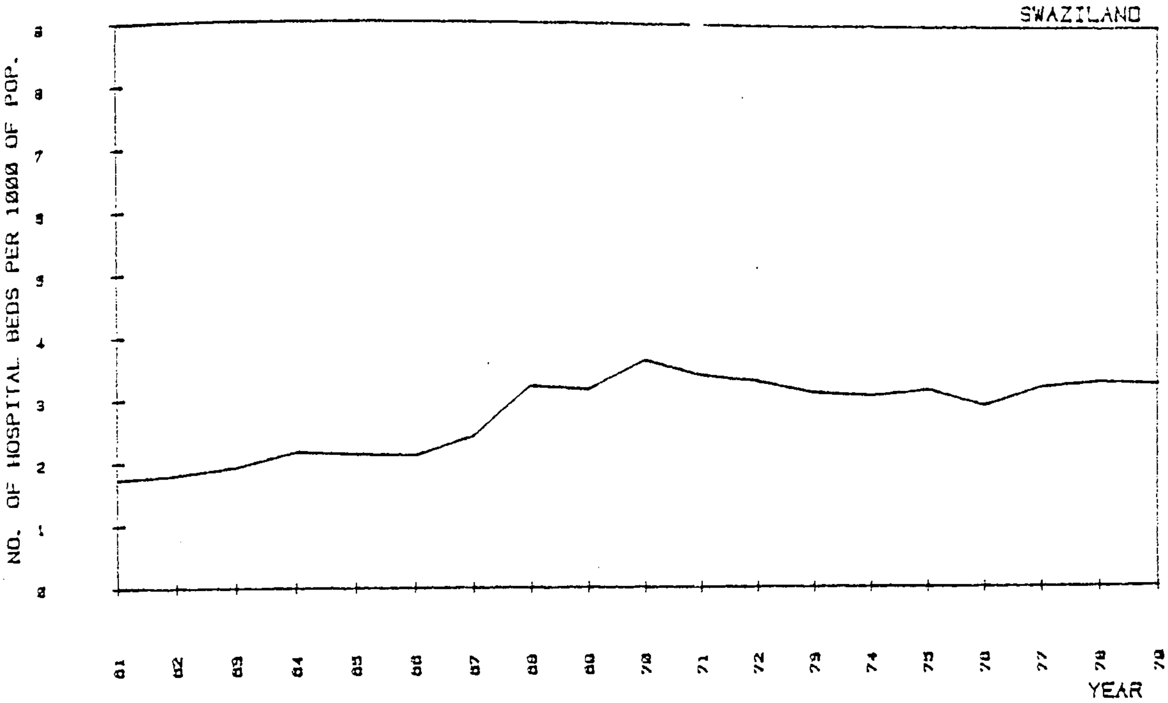

FIGURE A3-78: NUMBER OF HOSPITAL BEDS PER 1000 OF POPULATION. (1961 - 1980)

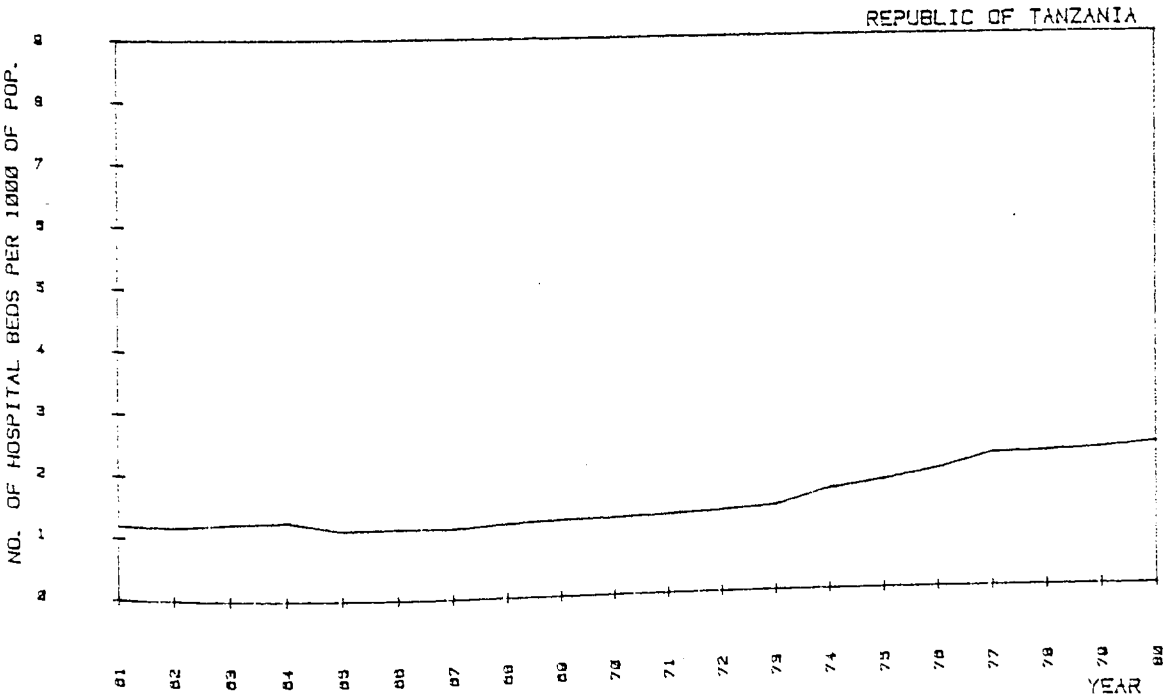

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FIGURE A3-79: GROSS DOMESTIC PRODUCT PER CAPITA.
(1961 - 1979)

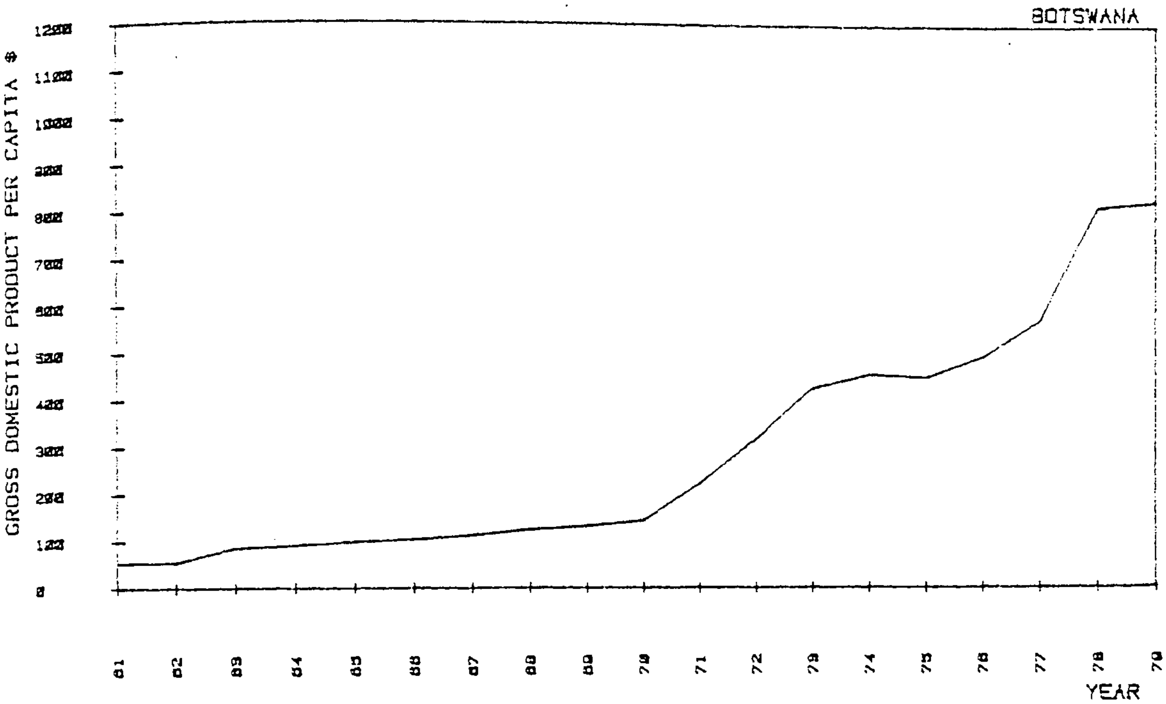

FIGURE A3-80: GROSS DOMESTIC PRODUCT PER CAPITA.
(1961 - 1979)

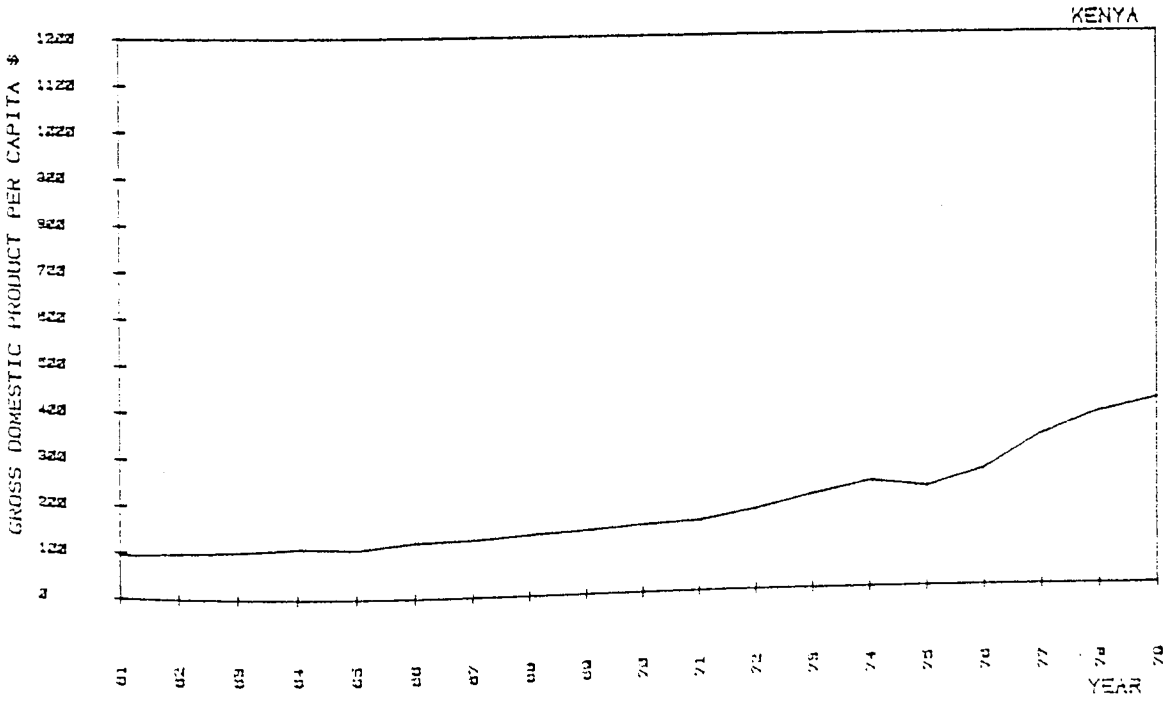

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FIGURE A3-81: GROSS DOMESTIC PRODUCT PER CAPITA.
(1961 - 1979)

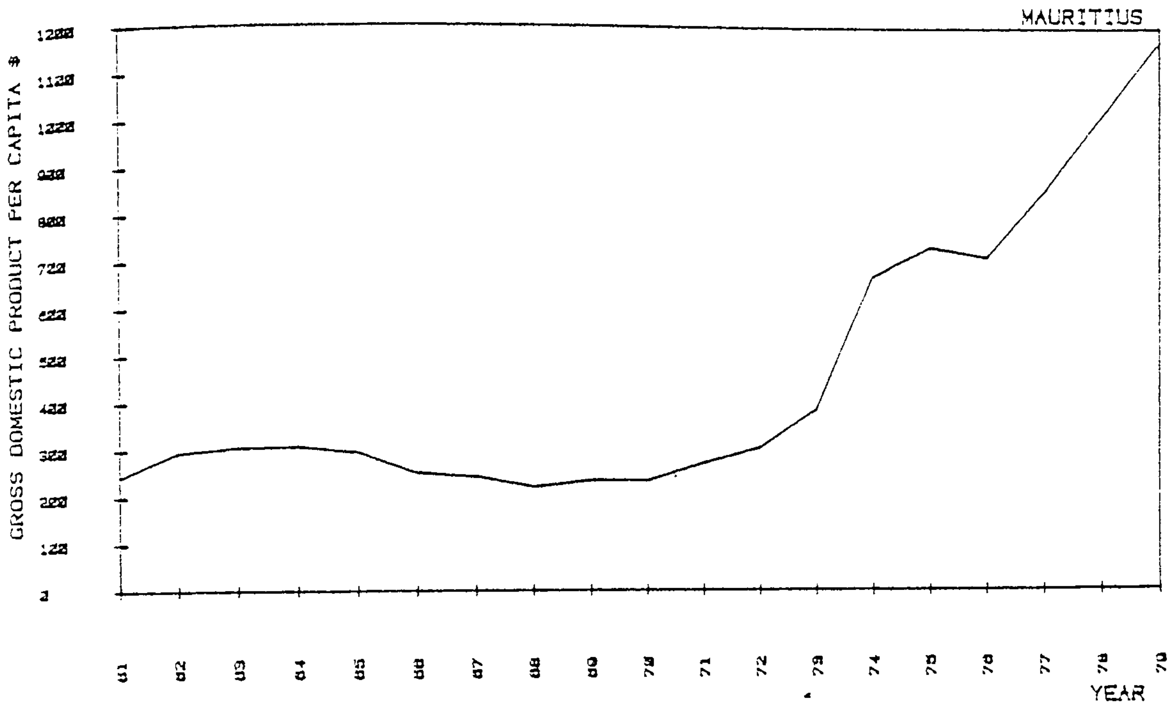

FIGURE A3-82: GROSS DOMESTIC PRODUCT PER CAPITA.
(1961 - 1980)

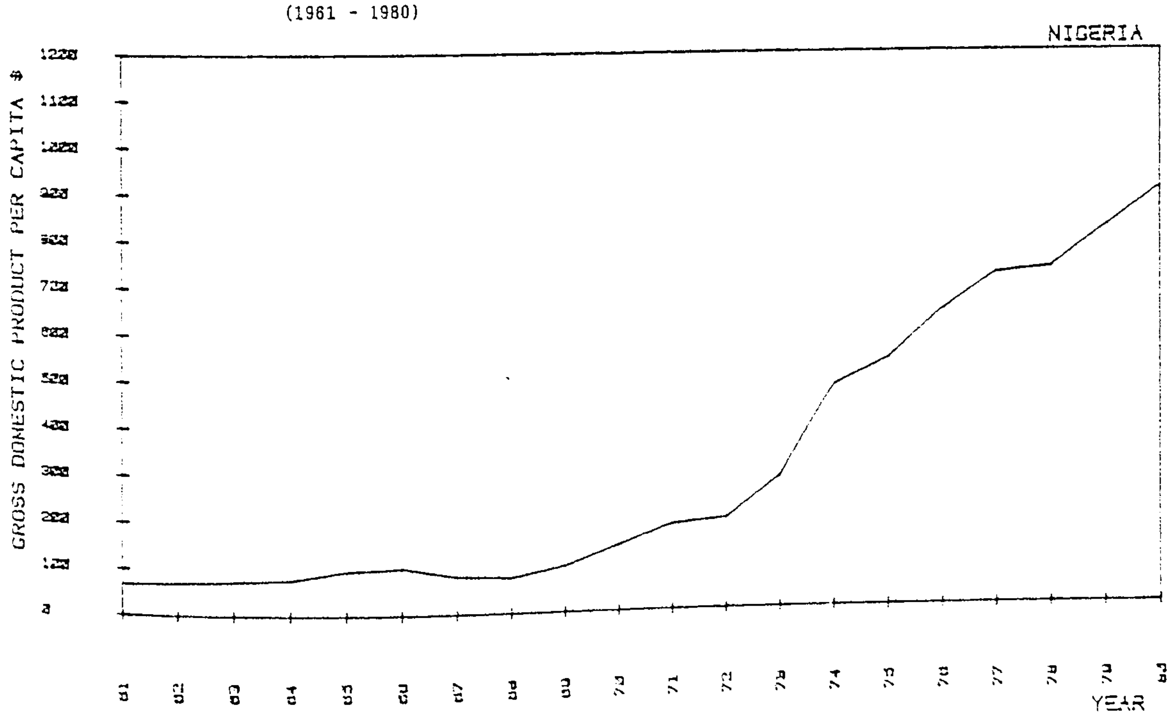

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FIGURE A3-83: GROSS DOMESTIC PRODUCT PER CAPITA. (1961 - 1979)

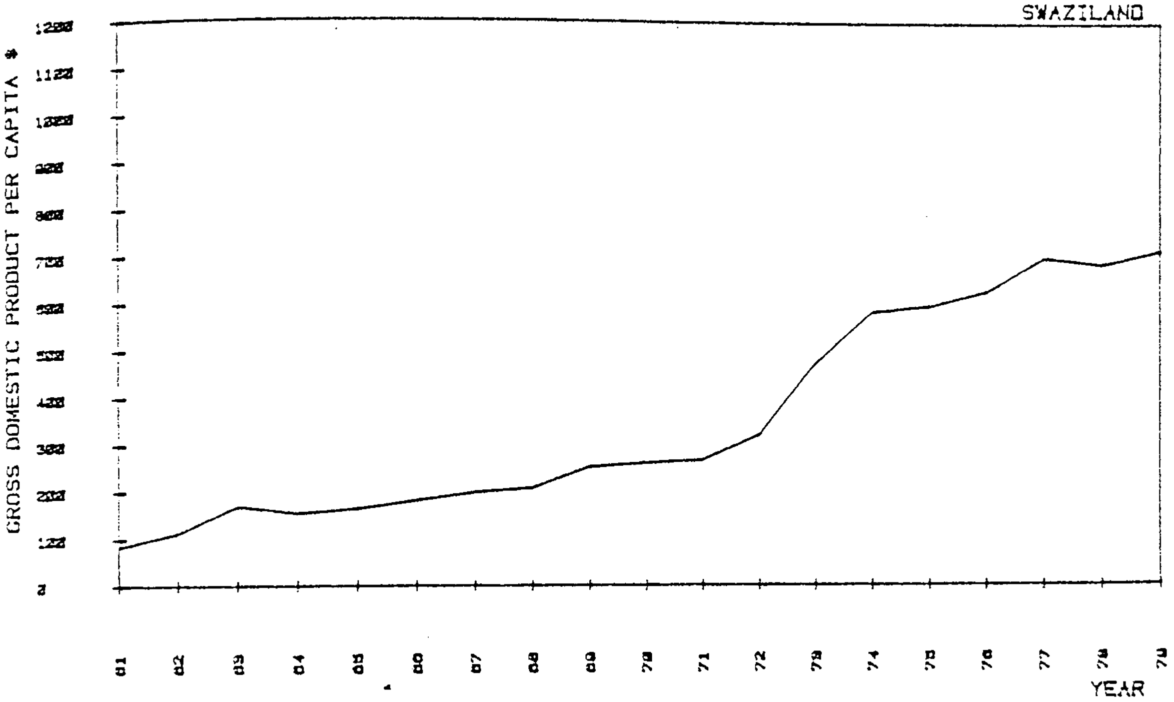

FIGURE A3-84: GROSS DOMESTIC PRODUCT PER CAPITA. (1961 - 1979)

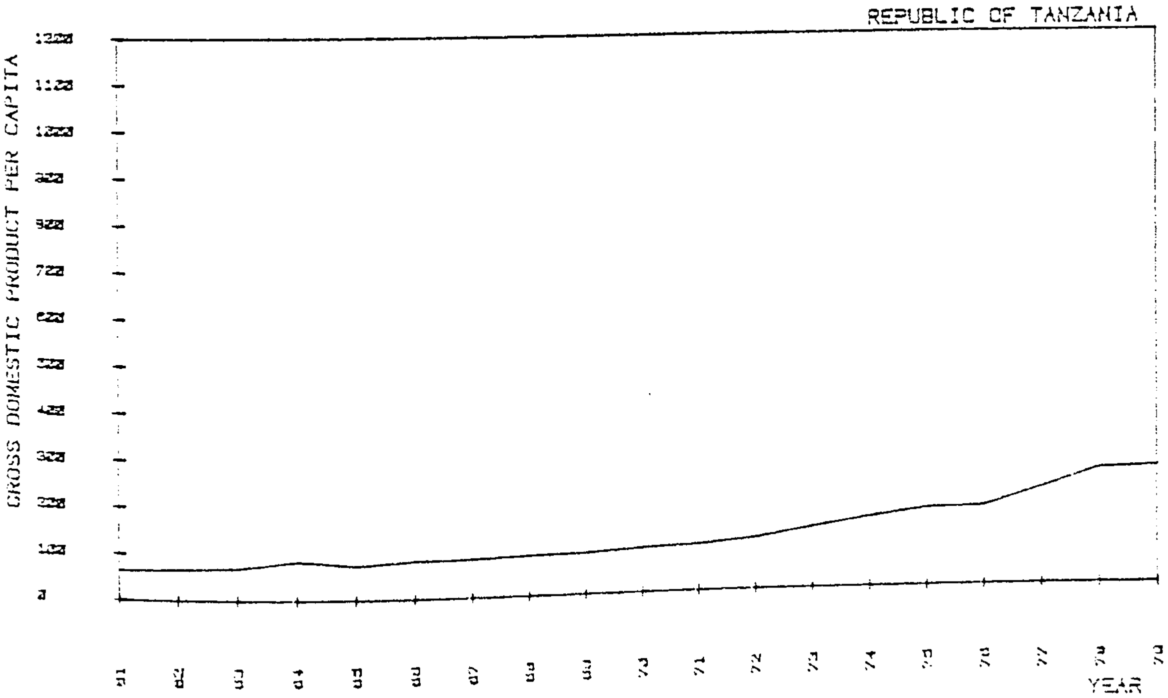

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FIGURE A3-85: EXPENDITURE ON AGRICULTURE BY GOVERNMENT.

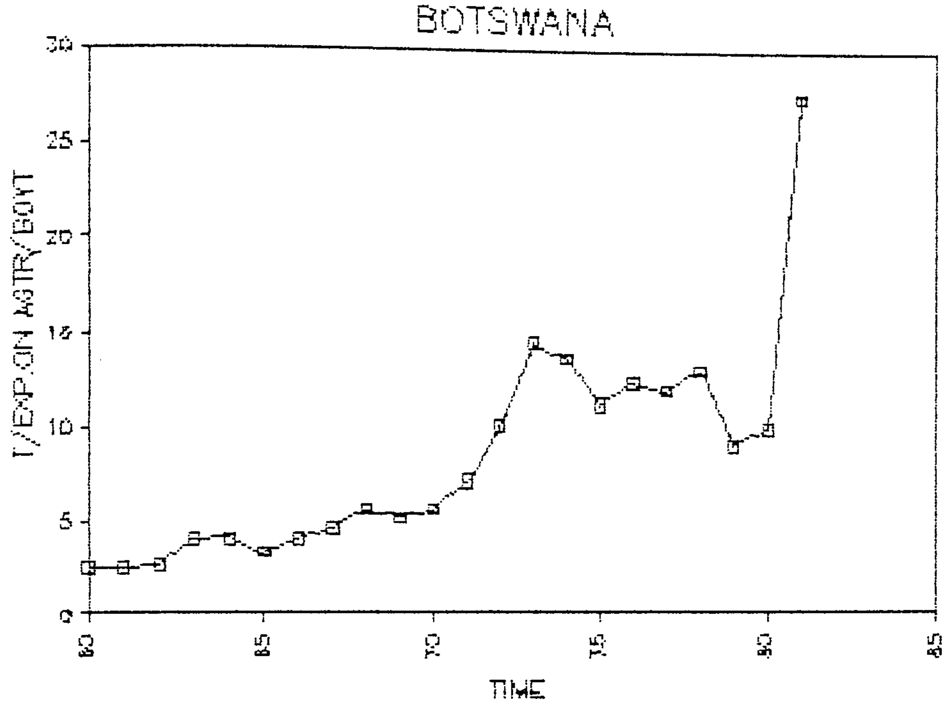


FIGURE A3-86: EXPENDITURE ON AGRICULTURE BY GOVERNMENT.

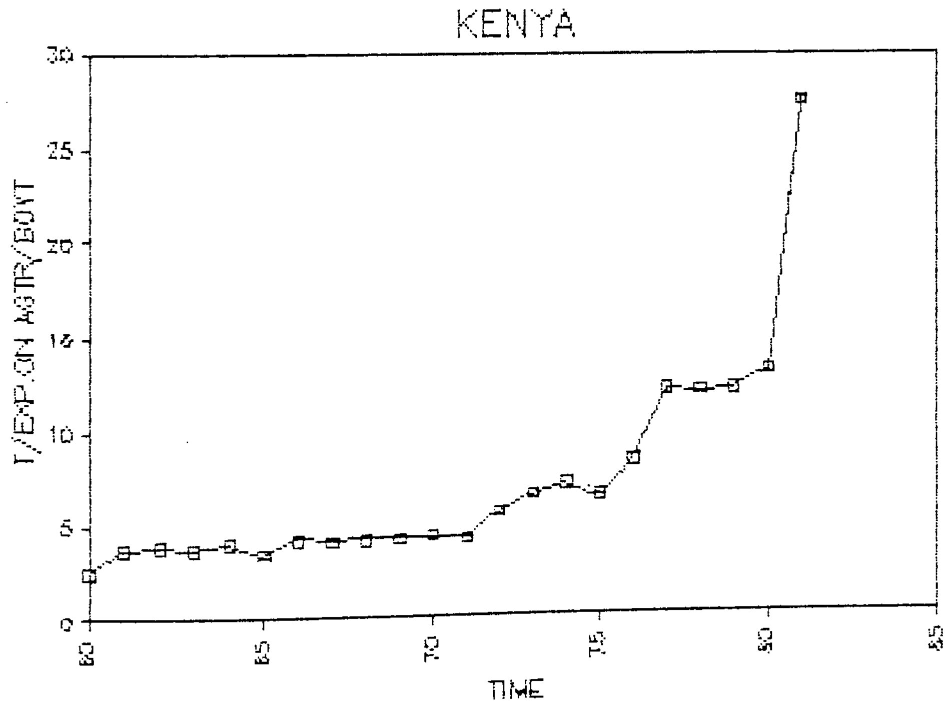


FIGURE A3-87: EXPENDITURE ON AGRICULTURE BY GOVERNMENT.

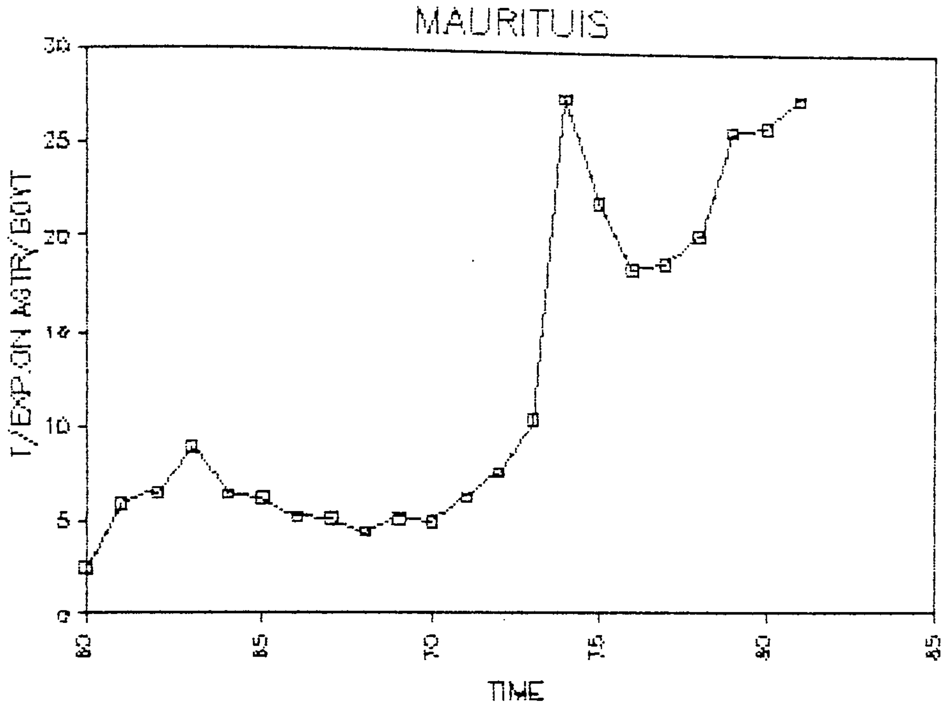


FIGURE A3-88: EXPENDITURE ON AGRICULTURE BY GOVERNMENT.

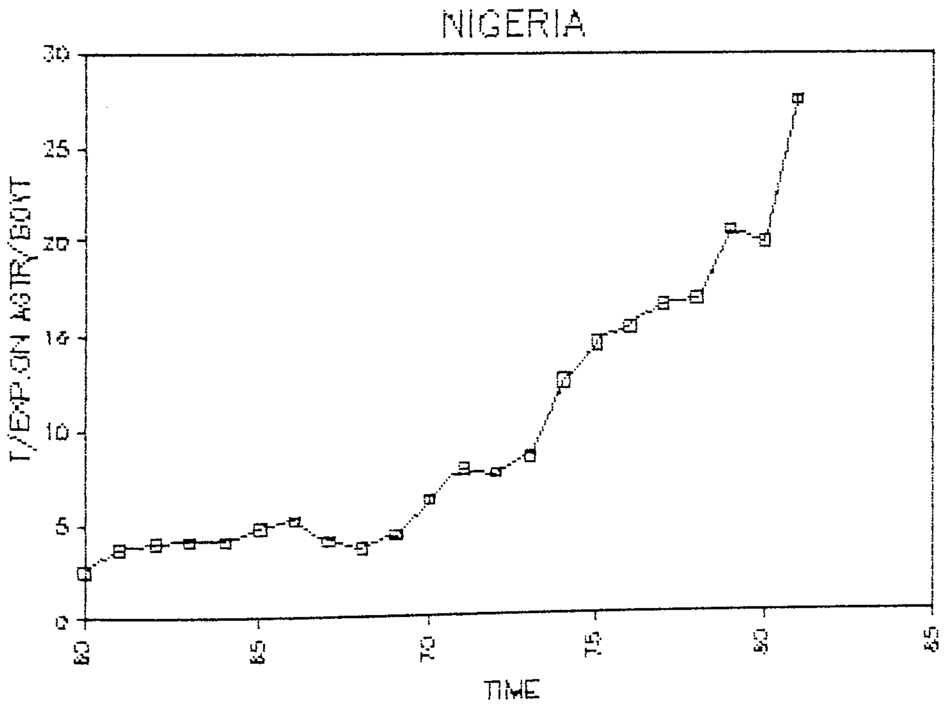


FIGURE A3-89: EXPENDITURE ON AGRICULTURE BY GOVERNMENT.

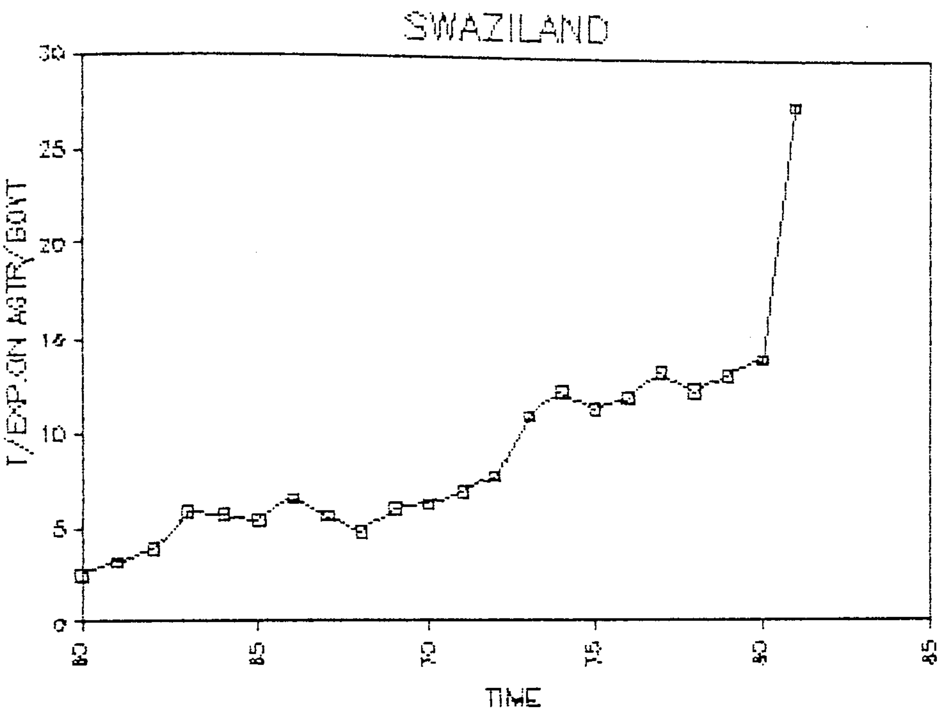
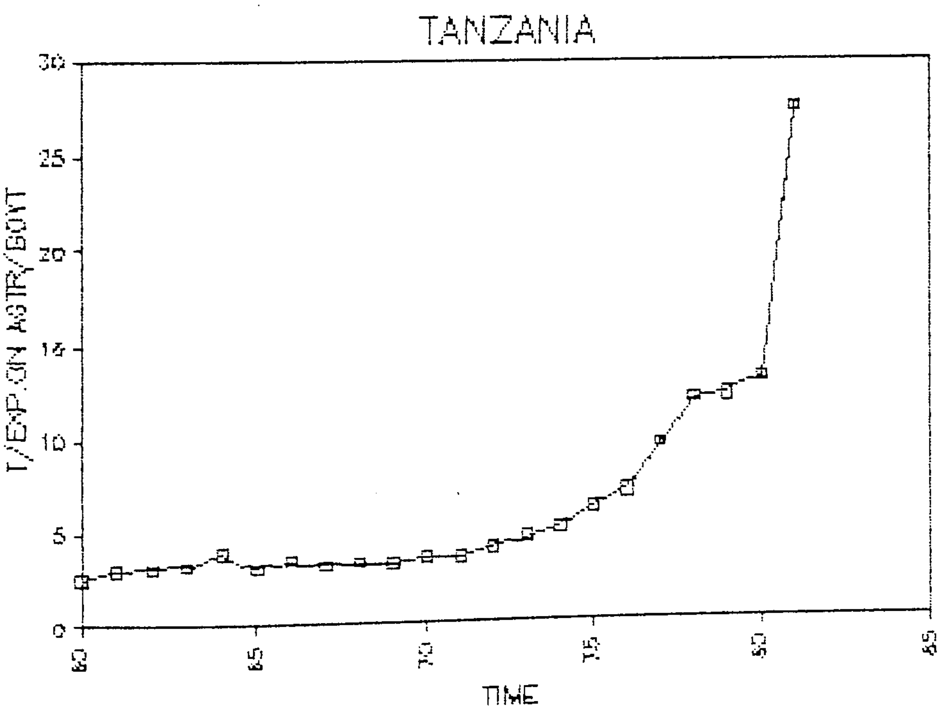


FIGURE A3-90: EXPENDITURE ON AGRICULTURE BY GOVERNMENT.



APPENDIX A-4

SOURCES OF DATA

Botswana

- Statistical Abstract
- Employment Survey of Botswana
- National account of Botswana
- Financial statements, Tables, and Estimates of Consolidated and Developments Fund Revenues - Botswana
- Supplementary Estimates of Expenditure - Botswana
- Medical and Sanitary Report - Botswana
- Report of the Department of Health - Botswana
- Report of the Ministry of Health - Botswana
- Botswana - National Plan
- Botswana Medical Statistics
- Country Demographic Profiles - Botswana
- Botswana - Government Information Services
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- Botswana - Department of Agriculture - Annual Report
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- Colony and Protectorate of Kenya - Statistical Abstract
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APPENDIX A-5

RATE OF EXCHANGE

RATE OF EXCHANGE

The Rates of Exchange used throughout of the study were extracted from Monthly Bulletin of Statistics (United Nations). The followings show the National currencies of the countries involved in the study and also the rates of exchange of these currencies to U.S. dollar between period 1971-1980.

Continued..........

Botswana

FINANCE

CURRENCY AND EXCHANGE RATES

Monetary Unit:

100 thebe = 1 pula (p).

Denominations:

Coins: 1, 2, 5, 10, 25 and 50 thebe; 1 pula.

Notes: 1, 2, 5, 10 and 20 pula.

Sterling and dollar Equivalents (31 March 1983)

£1 sterling = 1.605 pula;

$1 U.S. =1.082 pula;

100 pula =£62.32 = $92.45.

Average Exchange Rate (US $ per pula)

1980 - 1.2890

1981 - 1.1915

1982 - .9734

Note: The pula was introduced in August 1976, replacing (at par) the South African rand, which from September 1975 had a value of U.S.£1.15. On April 30th, 1977, the pula was revalued at US $ 1.2075. This remained in effect until September 1979, when a new rate of pula = $1.2679 was established. Since June 1980 the pula's value has been linked to a weighted "basket" of currencies.

Continued.........

Kenya

FINANCE

CURRENCY AND EXCHANGE RATES

Monetary Units

100 cents = 1 Kenya shilling (Ks).

20 Ks. = 1 Kenya pound (K£).

Denominations

Coin: 5, 10 and 50 cents; 1 Ks.

Notes: 5, 10, 20 and 100 Ks.

Sterling and Dollar Equivalents (31 March 1983)

£1 sterling = 19.34 Ks.

$1 U.S. = 13.03 Ks.

1,000 Ks. =£51.71 = $76.72

Average Exchange Rate (Ks. per US $)

1980 - 7.420

1981 - 9.048

1982 - 10.922

Note: The Kenya shilling was introduced in September 1966, replacing (at par) the East African shilling, equal to one shilling sterling (£ 1 = 20 shillings). From September 1949 the shilling was equivalent to 14 U.S. cents (U.S. $1 = 7.143 shillings) and this valuation remained in force until

Continued..........

June 1973. When the U.S. dollar was devalued in December 1971 the rate of Kenya shillings per IMF Special Drawing Right (SDR) was fixed at 7.755. In February 1973 the dollar was again devalued and the exchange rate became 1 SDR = 8.617 shillings. In June 1973 Kenya's currency was revalued by 3.5 per cent, with a new exchange rate of $1 = 6.90 shillings (1 SDR = 8.324 shillings), but in January 1974 the shilling was restored to its earlier valuation of 14 U.S. cents ($1 = 7.143 shillings). from July 1974 the fixed relationship between the SDR and the U.S. dollar was ended but the Kenya shilling remained tied to U.S. currency. This remained in force until october 1975, when the link between the shilling and the US dollar was ended and the shilling's value fixed at a mid-point of 9.66 per SDR, then equal to 8.16 per dollar, an effective devaluation of 12.5 per cent. The average exchange rate (shillings per U.S. dollar) was: 7.343 in 1975; 8.367 in 1976; 8.227 in 1977; 7.729 in 1978; 7.475 in 1979. The shilling was devalued in February 1981, when a new rate of 10.15 per SDR was introduced. In terms of sterling, the value of the Kenya shilling between November 1967 and August 1971 was IS. 2d. (5.83p), the exchange rate being£1 = 17.14 Ks.; from December 1971 to June 1972 the rate was £ 1 = 18.61 Ks. In this survey the symbol "K £" is used to denote amounts of 20 Ks., equivalent to £1.08 sterling in April 1981.

continued...

Mauritius

FINANCE

CURRENCY AND EXCHANGE RATE

Monetary Units

100 cents = 1 Mauritian Rupee

Denominations

Coins: 1, 2, 5, 25 and 50 cents; 1 rupee.

Notes: 5, 10, 25 and 50 rupees.

Sterling and Dollar Equivalents (31 March 1983)

£1 sterling = 16.786 rupees;

$1 U.S. = 11.315 rupees;

100 Mauritian rupee =£5.96 = $8.84.

Average Exchange Rate (Mauritian rupees per U.S. $)

1980 - 7.690

1981 - 9.091

1982 - 10.899

Note: Before January 1976 the Mauritian rupee was tied to the pound sterling, its value being fixed at 7½p (£1 = 13.333 rupees). From November 1967 to August 1971 the central exhcange rate was 1 rupee = 18 U.S. cents (U.S. $1 = 5.556 rupees). In December 1971 the U.S. dollar was devalued but the rupee retained its value in terms of sterling and the IMF Special

Continued..........

Drawing Right (SDR), so the new exchange rate was 1 rupee = 19.543 U.S. cents ($1 = 5.117 rupees). However, in June 1972 the rupee was "floated" in line with sterling. the average market exchange rates (rupees per U.S. dollar) were: 5.3385 in 1972; 5.4422 in 1973: 5.7031 in 1974: and 6.0268 in 1975. In January 1976 the rupee's link with sterling was broken and the currency was pegged to the SDR (based on a weighted "basket" of currencies since July 1974) at a mid-point of 7.714 rupees per SDR, representing a depreciation of 28per cent from its pre-float valuation. This rate remained in effect until October 1979, when a new rate of 1 SDR = 10 rupees was introduced. The exchange rate against the U.S. dollar is adjusted from month to month. The average rates (rupees per dollar) were: 6.6824 in 1976; 6.5996 in 1977; 6.1410 in 1978; 6.4017 in 1979; 7.6896 in 1980.

continued...

Nigeria

FINANCE

CURRENCY AND EXCHANGE RATES

Monetary Units

100 Kobo = 1 naira (₦)

Denominations

Coins: $\frac{1}{2}$, 1, 5, 10 and 25 Kobo

Notes: 50 Kobo; 1, 5, 10 and 20 naira.

Sterling and Dollar Equivalents (31 March 1983)

£1 Sterling = 1.056 naira;

U.S. $1 = 71.2 Kobo;

100 naira =£94.69 = $140.47

Average Exchange Rate (U.S. $ per naira)

1980 - 1.8297

1981 - 1.6292

1982 - 1.4854

Note: The naira was introduced on January 1st, 1973, replacing the Nigerian pount ₤N) of 20 shillings (240 pence) at the rate of £N1 = 2 naira. Between September 1949 and August 1971 the Nigerian pound was valued at U.S. $2.80. In December 1971 the value was revised to $3.04. The value of the naira was consequently fixed at $1.52 (U.S. $1 = 65.79 kobo). Despite

Continued.........

the devaluation of the U.S. dollar in February 1973, this exchange rate remained in effect until April 1974, since when the naira has been allowed to "float". The average value of the naira was $1.5904 in 1974; $1.6248 in 1975; $1.5959 in 1976; $1.5514 in 1977; $1.5745 in 1978; $1.6591 in 1979; $1.8297 in 1980. The Nigerian pound was at par with the pound sterling until November 1967, after which the exchange rate was £N1 = £ 1.167 sterling until June 1972.

continued...

Swaziland

FINANCE

CURRENCY AND EXCHANGE RATES:

Monetary Units

100 cents = 1 lilangeni (plural: emalangeni)

the lilangeni is at par with the South African Rand, which is also legal tender in Swaziland.

Denominations

Coins: 1, 2, 5, 10, 20 and 50 cents; 1 lilangeni

Notes: 1, 5, 10, and 20 emalangeni

Sterling and Dollar Equivalents (31 March 1983)

£1 sterling = 1.626 emalangeni;

U.S. $1 = 1.096 emalangeni;

100 emalangei =£61.51 = $91.24.

Average Exchange Rate (U.S. $ per lilangeni)

1980 - 1.285

1981 - 1.149

1982 - .923

Note: Since September 1974, Swaziland has issued its own currency, the lilangeni (plural: emalangeni), which is at par with the rand and circulates with it inside the country.

Continued........

Tanzania

FINANCE

CURRENCY AND EXCHANGE RATES

Monetary Units

100 cents = 1 Tanzanian shilling

Denominations

Coins: 5, 20 and 50 cents; 1 and 5 shillings

Notes: 5, 10, 20 and 100 shillings

Sterling and Dollar Equivalents (31 March 1983)

£sterling = 14.56 Tanzanian shillings;

U.S. $1 = 9.82 TAnzanian shillings;

100 Tanzanian shillings =£6.87 = $10.19

Average Exchange Rate (Tanzanian shillings per US $)

1980 - 8.195

1981 - 8.285

1982 - 9.334

Note: On 6 June 1984 the Tanzanian shilling was devaluated by 20%, with the exchange rate adjusted from 9.74 to 12.18 shillings per U.S. $.

Continued.........

TABLE A5-1

72	73	74	75	76	77	78	79	80
.783	.671	.690	.870	.870	.828	.828	.789	.742
7.143	6.900	7.143	8.260	8.310	7.917	7.404	7.328	7.569
5.678	5.739	5.677	6.589	6.639	6.350	5.921	7.586	7.835
.658	.658*	.616	.627	.651	.648	.561	.544	.5445
.783	.671	.680	.870	.870	.870	.870	.827	.746
7.143	6.900	7.143	8.260	8.324	7.960	7.415	8.221	8.181

* On 1 January 1973 a new monetary unit, the Naira, replaced the Nigerian Pound at the rate of 2 Naira per Nigerian pound.

APPENDIX A-6

PEARSON CORRELATION ANALYSIS RESULTS

NOTATION

MR	=	MORTALITY RATE
LEAB	=	LIFE EXPECTANCY AT BIRTH
URB	=	URBANISATION
PSP	=	NUMBER OF PRIMARY STUDENTS AS PERCENTAGE OF POPULATION
REE	=	RECURRENT EXPENDITURES ON EDUCATION
CEE	=	CAPITAL EXPENDITURE ON EDUCATION
REH	=	RECURRENT EXPENDITURE ON HEALTH
CEH	=	CAPITAL EXPENDITURE ON HEALTH
PHY	=	NUMBER OF PHYSICIANS PER 10000 OF POPULATION
NUR	=	NUMBER OF NURSES PEER 1000 OF POPULATION
BED	=	NUMBER OF HOSPITAL BEDS PER 1000 OF POPULATION
GDP	=	GROSS DOMESTIC PRODUCT PER CAPITA
AGR	=	EXPENDITURE ON AGRICULTURE

Table A6 1

	MR	LEAB	URB	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	GDP	AGR
MR	1												
LEAB	-.8644	1											
URB	-.9044	.8499	1										
PSP	-.9336	.9110	.9203	1									
REE	-.8523	.8654	.9447	.9545	1								
CEE	-.7817	.5299	.5883	.5760	.3971	1							
REH	-.7161	.7737	.9044	.8190	.8806	.3254	1						
CEH	-.6845	.6310	.6681	.7057	.7642	.3408	.4076	1					
PHY	-.8654	.8914	.9514	.9599	.9711	.4576	.9048	.6359	1				
NUR	-.8570	.8936	.9330	.9572	.9872	.3917	.8583	.7510	.9751	1			
BED	-.9062	.8130	.9018	.9166	.9025	.6353	.6734	.7992	.8932	.8740	1		
GDP	-.8411	.7153	.9616	.8832	.8979	.5392	.9154	.5249	.9441	.8819	.8587	1	
AGR	-.4124	.5824	.4971	.4048	.4711	.2084	.6098	.2039	.4583	.4156	.3233	.2286	1

Botswana 1971-80
Pearson Correlation

continued....

	MR	LEAB	URB	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	GDP	AGR
MR	1												
LEAB	-.6626	1											
URB	-.9574	.6658	1										
PSP	-.7352	.3082	.8405	1									
REE	-.9293	.6489	.9757	.7978	1								
CEE	-.9657	.5994	.9819	.8455	.9643	1							
REH	-.8887	.8844	.8634	.5341	.8348	.8288	1						
CEH	-.5635	.4188	.7360	.6766	.7095	.7151	.5567	1					
PHY	-.9285	.7137	.8458	.6016	.7871	.8531	.9060	.4293	1				
NUR	-.8537	.5018	.9246	.9329	.8786	.9180	.7086	.7019	.7980	1			
BED	-.6373	.4151	.6404	.7936	.5503	.6420	.5416	.2513	.6966	.7892	1		
GDP	-.9173	.6605	.9649	.8850	.9259	.9501	.8323	.6664	.8631	.9723	.7849	1	
AGR	-.9137	.5625	.9202	.8352	.8548	.9379	.7715	.6518	.8993	.9561	.7558	.9445	1

Botswana 1961-70
Pearson Correlation

continued....

Table A6-3

	MR	LEAB	URB	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	GDP	AGR
MR	1												
LEAB	-.8314	1											
URB	-.9955	.8688	1										
PSP	-.8393	.8131	.8653	1									
REE	-.9729	.7654	.9639	.8322	1								
CEE	-.8436	.5047	.8066	.6701	.8528	1							
REH	-.9649	.7603	.9541	.8017	.9262	.8806	1						
CEH	-.9373	.8044	.9284	.8339	.8726	.8631	.9193	1					
PHY	.8936	-.8864	-.9082	-.8366	-.7855	-.6485	-.8529	-.9204	1				
NUR	-.8544	.8816	.8895	.8770	.7606	.5543	.8070	.8375	-.9392	1			
BED	-.6922	.7651	.7419	.8915	.6712	.5097	.6541	.6574	-.7224	.8391	1		
GDP	-.9867	.7396	.9714	.7566	.9832	.8030	.9894	.9010	-.8913	.8540	.6334	1	
AGR	-.6367	.4367	.6152	.4588	.7712	.5436	.4979	.4594	-.3283	.2967	.2901	.9733	1

Kenya 1971-80
Pearson Correlation

continued....

Table A6-4

	MR	LEAB	URB	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	GDP	AGR
MR	1												
LEAB	-.7106	1											
URB	-.9159	.8745	1										
PSP	-.7332	.8192	.8633	1									
REE	-.3966	.7549	.6366	.8521	1								
CEE	-.8147	.6190	.8164	.7936	.6195	1							
REH	-.5848	.7915	.7679	.9273	.9564	.7928	1						
CEH	-.7061	.7979	.8696	.9535	.8942	.8629	.9571	1					
PHY	-.3766	.6540	.6616	.7328	.8681	.6926	.8693	.8773	1				
NUR	-.9272	.8378	.9817	.9026	.6896	.8659	.8209	.9083	.6683	1			
BED	-.6593	.3153	.6111	.5767	.4134	.8801	.5683	.6875	.5398	.6709	1		
GDP	-.8769	.8162	.9692	.9133	.7263	.8789	.8405	.9441	.7503	.9852	.6981	1	
AGR	-.6822	.6186	.7894	.7792	.6008	.6843	.6604	.8080	.6633	.8037	.5424	.8730	1

Kenya 1961-70
Pearson Correlation

continued....

Table A6-5

	MR	LEAB	URB	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	GDP	AGR
MR	1												
LEAB	-.2205	1											
URB	.6568	-.8479	1										
PSP	.6132	-.8558	.9802	1									
REE	-.5886	.8724	-.9712	-.9777	1								
CEE	-.5567	.7273	-.8346	-.8274	.9116	1							
REH	-.5141	.8976	-.9570	-.9551	.9858	.9074	1						
CEH	-.7025	.6495	-.9057	-.9087	.8914	.8593	.8692	1					
PHY	-.4330	.9222	-.9201	-.8949	.9258	.8134	.9669	.7554	1				
NUR	-.5876	.7900	-.9409	-.8936	.9160	.8258	.9280	.8312	.9263	1			
BED	.6327	-.8758	.9822	.9598	-.9450	-.7936	-.9249	-.8506	-.9014	-.9048	1		
GDP	.6645	.1569	.1715	.1698	-.1227	-.2336	-.0028	-.3633	.1293	-.1025	.2155	1	
AGR	.2769	.0957	.0146	.0737	-.0798	-.2841	.0064	-.2521	.1595	.0093	.0384	9161	1

Mauritius 1971-80
Pearson Correlation

continued....

	MR	LEAB	URB	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	GDP	AGR
MR	1												
LEAB	-.6181	1											
URB	.7805	-.6235	1										
PSP	-.5748	.4727	-.2765	1									
REE	-.8533	.7963	-.8877	.6567	1								
CEE	.3982	-.1736	.2273	-.1430	-.2136	1							
REH	-.6140	.7854	-.5505	.7590	.8241	-.3235	1						
CEH	-.1742	-.0443	-.3148	-.1356	.1737	.3770	-.1439	1					
PHY	-.5237	.5291	-.1036	.7514	.4538	.0089	.4487	.0345	1				
NUR	-.4072	.6239	-.1524	.9124	.5651	-.0857	.7413	-.2839	.8156	1			
BED	.7346	-.5672	.8443	-.4548	-.8280	-.0342	-.4540	-.4827	-.4384	-.3657	1		
GDP	.3126	-.3826	.7957	.2398	-.5136	.0946	-.2361	-.4001	.4035	.2876	.5476	1	
AGR	.5266	-.3621	.7485	.2080	-.4685	.1960	-.1018	-.4190	.1703	.2749	.6307	.8296	1

Mauritius 1961-70
Pearson Correlation

continued....

Table A6-7

	MR	LEAB	URB	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	GDP	AGR
MR	1												
LEAB	-.8346	1											
URB	-.9643	.8853	1										
PSP	-.7802	.8055	.9080	1									
REE	-.8913	.8409	.8990	.7631	1								
CEE	-.7742	.8550	.8791	.9305	.8487	1							
REH	-.7223	.8007	.8651	.9335	.7810	.9574	1						
CEH	-.5059	.7934	.5679	.3356	.5841	.3579	.5266	1					
PHY	-.7285	.8174	.8748	.9628	.7602	.9572	.9964	.5420	1				
NUR	-.7193	.8444	.8525	.9757	.8354	.9559	.9535	.6915	.9617	1			
BED	-.9601	.8201	.9578	.7924	.8752	.7684	.7470	.5453	.7540	.7464	1		
GDP	-.9301	.9110	.9852	.9249	.9096	.8935	.8814	.6416	.8931	.8801	.9124	1	
AGR	-.9084	.9012	.9688	.9204	.9339	.9330	.8930	.6223	.8961	.8633	.8874	.9886	1

Nigeria 1971-80
Pearson Correlation

continued....

Table A6-8

	MR	LEAB	URB	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	GDP	AGR
MR	1												
LEAB	-.7779	1											
URB	-.9665	.7740	1										
PSP	.5082	-.0863	-.6130	1									
REE	-.9853	.7511	.9573	-.4791	1								
CEE	-.9084	.9521	.8666	-.1815	.8899	1							
REH	-.6791	.2239	.7486	-.9464	.6823	.3612	1						
CEH	-.8911	.8982	.8272	-.1128	.8795	.9678	.2991	1					
PHY	-.9843	.8029	.9842	-.5054	.9799	.9049	.6753	.8888	1				
NUR	-.9122	.6225	.9410	-.7869	.8941	.7271	.8868	.6597	.9046	1			
BED	-.1747	.1968	.3784	-.4844	.1254	.1263	.3711	.0241	.2702	.3087	1		
GDP	-.7343	.9198	.8007	-.1611	.7545	.8623	.3091	.8151	.8133	.6289	.3395	1	
AGR	-.5241	.8689	.6145	-.0005	.5408	.7347	.1122	.6536	.6197	.4365	.3782	.9539	1

Nigeria 1961-70
Pearson Correlation

continued....

Table A6-9

	MR	LEAB	URB	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	GDP	AGR
MR	1												
LEAB	-.7964	1											
URB	-.8167	.9043	1										
PSP	-.9092	.8729	.9280	1									
REE	-.7823	.7630	.9792	.8486	1								
CEE	-.8226	.6787	.7778	.8501	.7654	1							
REH	-.7841	.8592	.9633	.9530	.9598	.8589	1						
CEH	-.1030	.1912	.4146	.3220	.2680	-.0852	.4851	1					
PHY	-.4336	.7282	.5786	.5048	.4992	.5837	.4927	-.0585	1				
NUR	-.9322	.8381	.9035	.9685	.8593	.8195	.8900	.3014	.5446	1			
BED	.3926	-.1807	-.0071	-.3360	.0887	-.4643	-.1570	.6444	-.2606	-.3073	1		
GDP	-.9486	.8124	.8640	.9669	.8255	.8447	.9171	-.1191	.4686	.9544	-.3860	1	
AGR	-.3676	.5890	.6150	.6531	.7419	.8349	.7744	.6221	.1923	.4987	-.4654	-.9755	1

Swaziland 1971-80
Pearson Correlation

continued....

Table A6-10

	MR	LEAB	URB	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	GDP	AGR
MR	1												
LEAB	-.8553	1											
URB	-.9519	.8310	1										
PSP	-.9506	.7907	.8592	1									
REE	-.7019	.7310	.5735	.6798	1								
CEE	-.0283	.1771	.1839	-.0930	.2789	1							
REH	-.7988	.7957	.6004	.8275	.8051	-.1966	1						
CEH	-.9089	.7205	.9489	.8034	.6661	.2859	.5538	1					
PHY	.3307	-.0992	-.1901	-.4401	-.0334	.4851	-.4548	-.1572	1				
NUR	-.9449	.8144	.9089	.8561	.6524	-.0569	.7527	.8891	-.3055	1			
BED	-.9243	.8182	.7888	.9262	.7886	-.1526	.9169	.7659	-.3588	.9206	1		
GDP	-.9635	.8181	.9095	.8930	.6390	-.0264	.7949	.8706	-.4508	.9507	.8941	1	
AGR	-.6394	.5433	.7385	.5027	.1205	.0515	.3240	.6645	-.4807	.6911	.4343	.7541	1

Swaziland 1961-70
Pearson Correlation

continued....

Table A6-11

	MR	LEAB	URB	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	GDP	AGR
MR	1												
LEAB	-.8834	1											
URB	-.9836	.8991	1										
PSP	-.9504	.9028	.9776	1									
REE	-.9151	.8745	.9376	.9586	1								
CEE	-.8183	.7767	.8073	.7952	.9222	1							
REH	-.9526	.8279	.9672	.9566	.9401	.9248	1						
CEH	-.8345	.7642	.8982	.8979	.9112	.8687	.9307	1					
PHY	-.7521	.8118	.8159	.8472	.9093	.8084	.7360	.8447	1				
NUR	-.9631	.9070	.9906	.9855	.9621	.8296	.9426	.8900	.8675	1			
BED	-.9703	.8954	.9919	.9795	.9499	.8258	.9517	.8821	.8130	.9913	1		
GDP	-.9566	.8153	.8765	.9663	.9722	.9569	.9862	.9485	.8098	.9679	.9679	1	
AGR	-.5332	.5688	.4904	.4839	.6672	.8750	.9570	.9650	.5670	.5207	.5253	.9887	1

Tanzania 1971-80
Pearson Correlation

continued....

Table A6-12

Tanzania 1961-70
Pearson Correlation

	MR	LEAB	URB	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	GDP	AGR
MR	1												
LEAB	-.7163	1											
URB	-.9865	.7756	1										
PSP	-.8053	.4841	.8159	1									
REE	-.9262	.8770	.9573	.6888	1								
CEE	-.9242	.8923	.9577	.7106	.9904	1							
REH	-.7461	.9574	.8102	.5049	.9070	.9225	1						
CEH	-.6516	.9279	.7082	.4024	.7927	.8354	.9622	1					
PHY	.7648	-.4920	-.7355	-.5112	-.6425	-.5887	-.4582	-.3726	1				
NUR	-.8959	.4902	.8879	.9377	.7444	.7530	.5437	.4447	-.6672	1			
BED	-.0419	.4567	.1891	.1168	.3218	.3129	.4841	.3924	.0822	.0811	1		
GDP	-.9079	.7351	.9456	.8615	.9256	.9334	.7653	.6297	-.5358	.8620	.3403	1	
AGR	-.3767	.3268	.4632	.7070	.4526	.4804	.3509	.2111	.0531	.5422	.5558	.7137	1

continued....

Table A6-13

	MR	LEAB	URB	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	GDP	AGR
MR	1												
LEAB	-.9284	1											
URB	-.9502	.9562	1										
PSP	-.8358	.8266	.8910	1									
REE	-.7317	.8034	.8580	.9253	1								
CEE	-.8081	.8194	.8593	.7891	.7138	1							
REH	-.6944	.7721	.8302	.8512	.9314	.6647	1						
CEH	-.6820	.7403	.7793	.7956	.8690	.6842	.6623	1					
PHY	-.8830	.9199	.9539	.9359	.9474	.8066	.9133	.8028	1				
NUR	-.8440	.8629	.9152	.9731	.9614	.4725	.8931	.8392	.9704	1			
BED	-.2254	.0964	.1268	.4364	.2482	.1103	.1818	.1863	.2430	.3616	1		
GDP	-.8414	.8734	.9511	.8942	.9205	.8392	.9247	.7588	.9709	.9234	.1519	1	
AGR	-.4290	.5151	.5169	.5161	.5852	.4296	.6817	.4024	.5557	.5349	.0598	.8203	1

Botswana 1961-80
Pearson Correlation

continued....

Table A6-14

	MR	LEAB	URB	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	GDP	AGR
MR	1												
LEAB	-.8633	1											
URB	-.8861	.9464	1										
PSP	-.7447	.8595	.9357	1									
REE	-.7363	.8555	.9503	.7460	1								
CEE	-.6118	.6259	.7915	.7950	.8726	1							
REH	-.7266	.8231	.9368	.9303	.9720	.9029	1						
CEH	-.7669	.8350	.9369	.9285	.9418	.8902	.9582	1					
PHY	-.5881	.7175	.6083	.4753	.5058	.2990	.4442	.4951	1				
NUR	-.8968	.9593	.9805	.9215	.8949	.6924	.8833	.8981	.6520	1			
BED	-.7274	.8145	.8922	.9542	.8791	.7228	.8677	.8581	.4698	.8989	1		
GDP	-.7288	.8117	.9342	.9104	.9721	.8599	.9930	.9502	.4335	.8953	.8549	1	
AGR	-.3630	.3681	.5135	.5084	.6699	.6046	.5419	.5142	.1380	.3791	.4184	.9830	1

Kenya 1961-1980
Pearson Correlation

continued....

Table A6-15

	MR	LEAB	URB	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	GDP	AGR
MR	1												
LEAR	-.7553	1											
URB	.9018	-.8743	1										
PSP	.5430	-.8014	6729	1									
REE	-.6763	.9015	-.7844	-.9617	1								
CEE	-.5598	.7638	-.6525	-.8769	.9292	1							
REH	-.6906	.9319	-.8053	-.9316	.9901	.9128	1						
CEH	-.4379	.4690	-.5297	-.7186	.6696	.6884	.6308	1					
PHY	-.7391	.9606	-.8218	-.8546	.9441	.8315	.9740	.5458	1				
NUR	-.7901	.9415	-.8507	-.7942	.9066	.7873	.9371	.4905	.9685	1			
BED	.8638	-.8019	.9327	.6004	-.7121	-.5915	-.7244	-.5841	-.7656	-.7770	1		
GDP	-.1485	.4409	-.2729	-.1093	.2345	.0656	.3358	-.1552	.4400	.3726	-.2175	1	
AGR	-.2996	.4830	-.3803	-.2415	.3262	.0997	.4068	-.0306	.5153	.4854	-.3161	.9324	1

Mauritus 1961-80
Pearson Correlation

continued....

Table A6-16

	MR	LEAB	URB	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	GDP	AGR
MR	1												
LEAB	-.9432	1											
URB	-.9876	.9586	1										
PSP	-.8121	.7072	.7907	1									
REE	-.9329	.8277	.9020	.8698	1								
CEE	-.8338	.7550	.8270	.9480	.9129	1							
REH	-.7551	.6638	.7640	.9368	.8470	.9797	1						
CEH	-.8456	.8582	.8502	.6719	.8453	.7080	.7123	1					
PHY	-.8626	.8025	.8755	.9531	.9007	.9702	.9759	.8016	1				
NUR	-.8873	.8812	.9371	.6404	.7680	.7264	.7474	.8071	.8404	1			
BED	-.9631	.8968	.9519	.8183	.9168	.8143	.7630	.8184	.8536	.8267	1		
GDP	-.9364	.8480	.9168	.9437	.9662	.9300	.8962	.8539	.9463	.8110	.9316	1	
AGR	-.9449	.8761	.9300	.9318	.9724	.9385	.8859	.8552	.9427	.8210	.9402	.9939	1

Nigeria 1961-80
Pearson Correlation

continued....

Table A6-17

Swaziland 1961-80
Pearson Correlation

	MR	LEAB	URB	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	GDP	AGR
MR	1												
LEAB	-.9573	1											
URB	-.8986	.9238	1										
PSP	-.9675	.9479	.9382	1									
REE	-.7838	.7865	.9160	.7976	1								
CEE	-.8599	.8276	.8543	.8357	.8798	1							
REH	-.8373	.8672	.9406	.8889	.9631	.9454	1						
CEH	-.6224	.6143	.7010	.6652	.5020	.3769	.6496	1					
PHY	.4330	-.2700	-.1598	-.3601	-.1021	-.1753	-.1668	-.3311	1				
NUR	-.9819	.9555	.9342	.9680	.8393	.8852	.8952	.6551	-.3488	1			
BED	-.7955	.7844	.6965	.8223	.4886	.4693	.5692	.6793	-.4857	.7579	1		
GDP	-.9506	.9184	.9265	.9361	.8858	.9343	.9648	.4622	-.3227	.9711	.6329	1	
AGR	-.4238	.5099	.6109	.5416	.8363	.9226	.7443	.6290	-.0617	.4955	.5904	.9833	1

continued....

Table A6-18

	MR	LEAB	URB	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	GDP	AGR
MR	1												
LEAB	-.9097	1											
URB	-.8377	.9074	1										
PSP	-.7036	.7976	.9615	1									
REE	-.7291	.8161	.9511	.9774	1								
CEE	-.7104	.7933	.9036	.9024	.9640	1							
REH	-.7656	.8629	.9817	.9671	.9700	.9740	1						
CEH	-.6149	.7131	.8957	.9401	.9421	.9061	.9379	1					
PHY	.1172	.1301	.3362	.4787	.4708	.4392	.2995	.4395	1				
NUR	-.8916	.8833	.9699	.9298	.9270	.8804	.9266	.8438	.2391	1			
BED	-.7039	.8251	.9720	.9850	.9695	.9151	.9739	.9257	.4757	.9233	1		
GDP	-.7542	.8258	.9782	.9797	.9861	.9810	.9897	.9539	.3350	.9405	.9794	1	
AGR	-.3163	.3921	.4954	.5407	.6554	.7954	.9470	.9774	.4035	.4871	.5556	.9751	1

Tanzania 1961-80
Pearson Correlation

continued....

APPENDIX A-7

PARTIAL CORRELATION ANALYSIS

TABLE A7-1

PARTIAL CORRELATION ANALYSIS

BETWEEN MORTALITY RATE AND

THE REST OF INDICATORS OF HEALTH MATRIX

WHEN CONTROLLING FOR URBANISATION AND G.D.P.

INDICATORS / CONTROLLING FOR	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	AGR
URB	-.6099	-.3160	-.1528	-.3965	-.1639	-.4646	-.6573	.7081	-.2189
GDP	-.4497	-.1790	.4912	-.3478	.1737	-.6975	-.6223	.2802	-.1596
URB & GDP	-.5932	-.3129	.0838	-.3978	-.0520	-.4277	-.6852	.7793	-.0810

Source: See text

TABLE A7-2

PARTIAL CORRELATION ANALYSIS
BETWEEN LIFE EXPECTANCY AT BIRTH AND
THE REST OF INDICATORS OF HEALTH MATRIX
WHEN CONTROLLING FOR URBANISATION AND G.D.P.

INDICATORS / CONTROLLING FOR	PSP	REE	CEE	REH	CEH	PHY	NUR	BED	AGR
URB	.5948	.4193	.1381	.4763	.1615	.5974	.7013	-.7373	.2780
GDP	.4381	.2973	-.5604	.4114	-.1923	.7598	.6542	-.3442	.1874
URB & GDP	.5572	.4604	-.2331	.4738	.0117	.5606	.7126	-.8291	.1219

Source: See text

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