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POPULATION CHANGE IN WEST AFRICA: 1954-1972

BY

NDIDI ODASHIONU OKWUMABUA

A thesis submitted  
in partial fulfillment of the requirements for the  
degree Master of Science, Major in  
Sociology, South Dakota  
State University

1974

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POPULATION CHANGE IN WEST AFRICA: 1954-1972

This thesis is approved as a creditable and independent investigation by a candidate for the degree, Master of Science, and is acceptable for meeting the thesis requirements for this degree. Acceptance of this thesis does not imply that the conclusions reached by the candidate are necessarily the conclusions of the major department.

Thesis Adviser

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NOO



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## CHAPTER I

### INTRODUCTION

In the light of recent concern over world population growth, it would be interesting to study to what extent West Africa as a developing area has experienced changes in fertility, mortality and natural increase. This study would be especially interesting in that developing countries like those in West Africa account for approximately two-thirds of the world's population.

Students of demography generally hold that as a rural agricultural country becomes more urbanized and industrialized, a transition also occurs in the demographic process. Under the influence of modernization, death rates decline rapidly while high fertility continues, producing a rapid population growth that continues until fertility declines to a level appropriate to such modernization.

This study proposes to examine the changes that have transpired in West African fertility, mortality and natural increase from 1954 to 1972 so as to evaluate the extent to which West Africa may be experiencing the process of demographic transition.

#### Statement and Importance of the Problem

This study examines the following problem: What changes have transpired in West African countries in fertility, mortality and

natural increase from 1954 to 1972, and how are these changes associated with social and economic measures of modernization?

As previously indicated, it is a somewhat regular demographic phenomenon that a country is undergoing demographic transition when the high birth rate and high death rate pattern change to one of continuing high birth rates but declining death rates. If it can be demonstrated that West Africa is experiencing this transition, then the current anticipated population explosion for that area may already be in the process of leveling and ultimately declining in force. Indications of this would be important information for people concerned with population growth, population change, family planning and allocation of health services in West African nations.

#### Objectives of the Study

The objectives of this study are:

1. To determine the changes that have transpired in West African nations and West Africa as a whole in fertility, mortality and natural increase from 1954 to 1972.
2. To determine the socioeconomic measures of modernization that are associated with these changes in fertility, mortality and natural increase.
3. To evaluate the extent to which West Africa may be experiencing the process of demographic transition based on the findings.

### Organization of the Thesis

This thesis is organized as follows:

1. Chapter I contains the introduction, statement and importance of the problem, research objectives and organization of the thesis.
2. Chapter II reviews selected pertinent literature.
3. Chapter III contains the conceptual orientation, theoretical framework and research hypotheses.
4. Chapter IV consists of the methodology.
5. Chapter V reports the descriptive findings.
6. Chapter VI reports the findings derived from multiple regression analysis.
7. Chapter VII presents summaries, conclusions, implications, recommendations and suggestions for further study.

## CHAPTER II

### REVIEW OF LITERATURE

#### Introduction

During recent decades population research relative to demographic processes in developing countries has been conducted more extensively by demographers. This review of literature examines selected works that serve as pertinent background to the conducting of research related to population change and modernization in developing countries; namely transition theory, fertility, mortality, socioeconomic factors, and urbanization.

#### Transition Theory

In its essential features, transition theory emphasizes a sequence with three major stages. Thomlinson (1965:22-24) has described the stages as:

Stage I (High Potential Growth). Stage I is the primitive condition of high birth rates and fluctuating high death rates with fluctuating low natural increase, short life expectancy and low median age. The economy is primitive and agricultural.

Stage II (Transition-Change). Stage II consists of three sub-stages:

1. A period of stable, high birth rates accompanied by declining death rates.



2. A period of continuing high birth rates accompanied by fairly low death rates.

3. A period of declining birth rates and fairly low death rates.

During this period the natural increase, or the annual difference between the number of births and the number of deaths for a given area, increases rapidly, resulting in greatly increased population growth.

In stage II the economy is both agricultural and industrial. The new demographic balance represents improved human efficiency and increased health standards with fewer deaths, less sickness, and fewer pregnancies, considerably less effort is required to bring a generation to maturity. In other words, life expectancy increases while median age is very young. Modern production, improved agricultural techniques and industrial manufacturing emerge.

Stage III (Incipient Decline). Stage III is the condition of low birth rates and low death rates which presumably follows the transition stage. Life expectancy is long, median age is high and natural increase is low. The economy is mature, industrial and metropolitan.

### Fertility

Thomlinson's study (1965:16) suggested that changes in fertility occur when children were no longer perceived by parents to be production durables but costly consumer durables instead.

Kammeyer (1971:21,32) supported Thomlinson's findings, in that his studies revealed that modernization had been considered a major factor influencing fertility. He noted that desire for a better standard of living or increased wealth, motivated couples to limit the number of their offspring. Hauser (1963:56) stated that birth rates in developing countries were likely to move downward, but the declines were not likely to be uniform among the countries.

### Mortality

In studies of mortality change Thomlinson (1965:91,94,95) and Kammeyer (1971:31-33) found that medical discoveries contributed to the decline of early mortality, and that rising standards of living resulted from substantial improvements in agricultural, industrial production and the ability to distribute goods quickly, widely and inexpensively.

Similarly, Hauser (1963:45) noted that improved health services, control of disease and scientific and medical advances, combined with the many facets of socioeconomic progress, yield declines in death rates. Goldsmith (1950:66) in reporting on a study made in Newfoundland, found that as the nutrition of mothers improved there was a corresponding reduction in infant mortality, and Kammeyer (1971:269) noted that a number of observers in recent years have stated that the infant mortality rate was the most sensitive index of technological development and transitional

process. Fryer (1965:40) also noted that the infant mortality rate is a much better index of the level of economic development than the crude death rate.

Okonjo and Caldwell (1968:14) stated that in the towns where the cash economy was dominant, where social and economic change were greatest, and where there were more doctors and hospitals, death rates were lower.

### Socioeconomic Factors

Hauser (1963:61-62) found the following socioeconomic factors to characterize the process of modernization in developing countries:

1. More production technologies which displace traditional methods of manufacturing, agriculture, trade, transport and communications.
2. More diversified and specialized economic activity.
3. Emphasis in production shifts from extractive industries, especially agriculture, to manufacturing, trade and communications.
4. Interchange of goods over widespread markets, replacing local consumption of goods produced on the farm or exchanged in small market.
5. Transformation of the labor force from illiteracy to literacy, with a sufficient supply of doctors, lawyers, engineers, entrepreneurs and managers.

6. Shift of the production center from small, family-oriented enterprises to large, professionally supervised organizations.

Bogue (1969:181) further stated that there must also be a vast segment of the population which possesses an intermediate level of education sufficient to read blueprints, technical specifications, measure in fractions and decimals and make judgments based on written instructions.

Accordingly, the United Nations Studies (1953:57) found that as the volume of non-agricultural employment expanded, its productivity multiplied many times through a sequence of technological innovations. The findings also reported that rising income levels permitted the development of health services, hospitals and medical research.

Ojo (1968:22) emphasized that the arrival of cash-cropping in Nigeria made possible great improvements in living conditions. Furthermore, they found that commercial agriculture provided the local population with more spending money.

Schnalberg (1970:399-425) found such items as telephones, newspapers and electric energy to be features characterizing modernization, and Kimble (1960:374) stated that industrialization was associated with increased numbers of vehicles, railways, ports and civil aviation facilities since factories could not function without the flow of raw materials.

Herskovits and Harwitz (1961:346) noted that during the past century, agricultural export crops constitute the principal sources of foreign exchange in tropical Africa.

Weller and Sly (1969:313,326) stated that per capita energy consumption is associated with modernization of a society and Gibbs and Martin (1969:313, 326) stressed that energy consumption is associated directly with complexity of the division of labor.

### Urbanization and Rurality

Cowgill (1969:190) noted that with increased industrialization, population tends towards more urban residence and that birth rates will decline first in Urban areas. Fryer (1965:42) also stated that the transformation of the society from predominantly rural to urban was one of the features of the transitional growth stage.

### Summary of Literature Review

The literature suggests the following findings relevant to this study:

1. Countries shifting from a primitive, rural, agricultural economy to a modern, urban, industrialized economy experience a corresponding adjustment in birth and death rates commonly labeled "demographic transition."
2. As countries develop, birth rates begin to decline during later stages of development.

3. Death rates decline during the early stages of modernization in developing countries.

4. Measures of modernization include such items as improved health services, less emphasis on extractive industry, economic diversification and specialization, expanded markets, higher educational attainment and the professionalizing of occupations, expanded commercial agriculture, increased communication networks, expanded energy consumption and relocation to urban residence.

## CHAPTER III

### THEORETICAL FRAMEWORK

#### Conceptual Orientation

The conceptual orientation to be used in this study is based upon and generated by established models. (Kerlinger, 1964: 31-32). These models attempted to conceptualize and explain demographic transition by showing the associations among variables, presenting a systematic view of the phenomena described by the variables and explaining transition phenomena. The two models utilized are Ford and De Jong's Analytic Systems Model (1970:7) and Thomlinson's (1965:22-24) Transition Model.

Ford and De Jong's Analytic Systems Model, Table 1, specifies elements in demographic transition which are associated with each other.

TABLE 1

TRAITS AND PROCESSES OF A DEMOGRAPHIC SYSTEM

Element Trait	Element Process	System Trait	System Process
Membership	Births, Deaths and Migration	Size	Growth: Gains through natality and in-migration minus losses through mortality and out-migration

This model attempts to symbolize the relationship between individual vital events and adjustments in the larger demographic system undergoing transition.

Further, this model helps in the analysis of demographic changes in West Africa, for the model portrays population growth to be a process dependent upon changing magnitudes of births, deaths and migration events. This is consistent with the component aspects of demographic transition theory.

#### Theoretical Framework

Thomlinson (1965:22-24) proposes transition theory, reviewed in the preceding chapter, as a suitable framework for explaining changes in population size in developing countries. Table 2 illustrates that in order to explain population growth in developing countries, basic demographic events must be specified, and variations in the number of those events associated with variations in the extent of modernization as measured by such factors as health services, industrial production, economic diversification and specialization, market expansion, educational attainments, commercial agriculture, communication, energy consumption and urbanization.



TABLE 2  
TRANSITION MODEL

To Explain	Kinds of Demographic Events Whose Number Must be Specified	Associated Factors
Population growth in developing countries	Number of births Number of deaths Number of migrants	Variations in extent of modernization

This model suggests that the plus or minus changes in fertility, mortality, infant mortality and natural increase result from advances to more extensive modernization in West Africa from 1954 to 1972.

#### Hypothesis

The two models suggest that the variation in the set of independent variables  $X_1, X_2, X_3, \dots, X_7$  will contribute significantly to the explanation of the variations observed in dependent variables  $Y$ , when the independent and dependent variables are defined as the plus or minus change in:

1. Energy consumption ( $X_1$ ).
2. Fertilizer consumption ( $X_2$ ).
3. The economically active population engaged in agriculture ( $X_3$ ).
4. The rural population ( $X_4$ ).
5. The urban population ( $X_5$ ).

6. The total population ( $X_6$ ).
7. The number of persons per physician ( $X_7$ ).
8. The number of live births ( $Y_1$ ).
9. The number of deaths ( $Y_2$ ).
10. The number of deaths occurring to children under one ( $Y_3$ ).
11. Natural increase ( $Y_4$ ).

## CHAPTER IV

### METHODOLOGY

#### Unit of Analysis

West African countries were used as units of analysis: Dahomey, Gambia, Ghana, Guinea, Ivory Coast, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo and Upper Volta.

#### Method of Collecting Data

Data was collected from the vital statistics reported in The United Nations Demographic Year Book 1955, 1961, 1966, 1963, 1964, 1971; 1972 World Population Data Sheet, Population Reference Bureau; The United Nations Statistical Year Book, 1966 and 1972; Production Year Book; Food and Agriculture Organization of the United Nations, 1955, 1966, 1972 and Economic Transition in West Africa.

#### General Procedure

Changes in fertility, mortality and natural increase for West Africa were determined by number and percent using standard demographic procedures.

To empirically test association a number of variables were selected and a null-hypothesis was formulated. The findings were analysed for conclusions and interpretations.

### Dependent Variable

The dependent variables were the absolute plus or minus change in the number of births, deaths, infant deaths and natural increase in west African countries from 1954 to 1972.

### Independent Variable

The independent variables were:

1. The absolute plus or minus change in energy consumption ( $X_1$ ).
2. The absolute plus or minus change in Fertilizer consumption ( $X_2$ ).
3. The absolute plus or minus change in the economically active population engaged in agriculture ( $X_3$ ).
4. The absolute plus or minus change in the Rural population ( $X_4$ ).
5. The absolute plus or minus change in the Urban population ( $X_5$ ).
6. The absolute plus or minus change in the total population ( $X_6$ ).
7. The absolute plus or minus change in number of persons per physician ( $X_7$ ).

### Mode of Analysis

The procedure used to analyze the association was ecological correlation, (Bogue, 1969:537-539 and Aderson & Zelditch, 1958:132); Ecological correlation tests the association among population

events and economic and social phenomena, controlling for ecological or geographical areas. The method of statistical analysis used was stepwise least squares multivariate regression. The level of significance was specified at .05.

This means of analysis accounts for the variability of the dependent variable through association with the set of independent variables. Use of this type of analysis permits testing the multiple effects of the set of independent variables. In addition, it enables the researcher to note the variance accounted for by the single most important variable, plus the cumulative variance accounted for by the additional variables in the set. The formula for the regression equation was:  $Y = a + b_1X_1 + b_2X_2 + \dots + b_7X_7$ .

### Explanations

Cape Verde Island and Port Guinea were excluded from this study because of lack of data.

In cases where data were not available in 1954 or 1972, the latest measure available since 1954 was used. In addition, data used in this thesis were the available data for the 14 West American countries studied.

## CHAPTER V

### DESCRIPTIVE ANALYSIS

This chapter fulfills study objective one: to determine the changes in fertility, mortality and natural increase that have transpired in West Africa and selected West African countries from 1954 to 1972.

When appropriate data are available, standard demographic procedures, in order to determine changes in fertility, mortality and natural increase, call for the use of standard comparison measures, such as crude birth and death rates, age-specific rates, and fertility ratios. As is known, however, demographic data for West African countries is not complete enough to calculate standard comparison measures for all sampled countries for both 1954 and 1972.

Consequently, this chapter will actually report the changes that have transpired in West Africa and selected West African nations from 1954 to 1972 in:

1. The number of births.
2. The number of deaths.
3. The number of deaths occurring to children under one.
4. The number of persons added to the population due to natural increase.

### Changes in Fertility

The measure of fertility used for comparison in this study is the actual number of births (Table 3).

West Africa as a whole experienced a birth increase of 1,300,955 or 33.45 percent, from 1954 to 1972. The percentage increase for the selected countries in West Africa ranged from Gambia's 87.98 percent to the decline of 34.71 percent for Niger. The lower birth percentage of Niger contributed to the lowered average percentage for West Africa. Niger's birth decline may be due to questionable reporting.

### Changes in Mortality

The measure of mortality used for comparison is the actual number of deaths (Table 4).

The number of deaths increased 209,294 (8.99 percent) in West Africa as a whole from 1954 to 1972. Ivory Coast experienced the highest mortality increase with 40.66 percent. Out of the three countries that experienced decline in deaths, Niger ranked the highest with a decline of 53.07. Niger's death decline may be due to incorrect data information on the part of the government of Niger.

### Changes in Infant Mortality

Infant mortality is considered to be the most sensitive index of transitional process. West Africa as a whole experienced

an increase in the number of deaths occurring to children under one of 620, or 1.18 percent (Table 5).

Six West African countries experienced drops in infant mortality from 1954 to 1972. The decline in infant mortality for those countries ranged from Niger's 51.68 percent to Togo's 5.94 percent. Niger's infant mortality decline could imply that Niger's Government did not furnish the correct data. Eight countries experienced increases. The increases ranged from Gambia's 104.28 percent to Ivory Coast's 26.11 percent.

#### Changes in Natural Increase

The rate of natural increase for a given population normally is obtained by calculating the difference between the birth rate and the death rate for a given area. In this study the actual number was used.

West Africa as a whole experienced a natural increase of 1,091,661 persons (69.86 percent) from 1954 to 1972 (Table 6). The increase ranged from Sierra Leone's 161.13 percent to Gambia's 2.47 percent. Togo's decline of 19.25 percent could be due to her low number of births of 11.37 percent.

#### Summary of Demographic Changes

The tables suggest the number of births, deaths, infant deaths and natural increase are all getting larger in West Africa as a whole; however, six countries experienced declines in infant



deaths and two countries experienced declines in deaths. Natural increase grew to 69.86 percent.

In view of the above characteristics, West Africa as a whole cannot be said to be experiencing demographic change in terms of standardized demographic changes because: (1) demographic data were not complete to compare the change. (2) With the available data used, her case appeared different from the standardized demographic change.

Stage I (High Potential Growth) stated that this stage is the primitive condition of high birth rates and fluctuating high death rates, with fluctuating low natural increase. But in the case of West Africa, natural increase is very high instead of being low. This implies that West Africa is on the verge of transition, but the transition will assume a different demographic change because of her ideology and culture.

Fertility is the primary determinant of age structure, and increased fertility generates young populations. Therefore, West African population is young since her percentage of birth experienced an increase of 33.45 percent from 1954 to 1972.

One characteristic that cannot be left untouched is the extremes of Niger's decline in births, deaths, infant mortality and natural increase. It seems almost correct that vital rates were misreported by the Niger government.

TABLE 3

CHANGES IN NUMBER OF BIRTHS FOR WEST AFRICA AND SELECTED WEST AFRICAN COUNTRIES, 1954-1972, BY NUMBER AND PERCENT

Country	Number 1954	Number 1972	Number Change 1954-1972	Percent Change 1954-1972
West Africa	3,888,745	5,189,700	1,300,955	33.45
Dahomey	100,980	140,000	39,020	38.64
Gambia	8,937	16,800	7,863	87.98
Ghana	288,660	451,200	162,540	56.31
Guinea	150,000	192,700	42,700	28.47
Ivory Coast	164,140	207,000	42,860	26.11
Liberia	46,000	60,000	14,000	30.43
Mali	223,260	265,000	41,740	18.70
Mauritania	42,500	52,800	10,300	24.24
Niger	326,560	213,200	-113,360	-34.71
Nigeria	2,018,520	2,900,000	881,480	43.67
Senegal	142,000	188,600	46,600	32.82
Sierra Leone	71,478	126,000	54,522	76.28
Togo	91,590	102,000	10,410	11.37
Upper Volta	214,120	274,400	60,280	28.15

TABLE 4

CHANGES IN NUMBER OF DEATHS FOR WEST AFRICA AND SELECTED WEST  
AFRICAN COUNTRIES, 1954-1972, BY NUMBER AND PERCENT

Country	Number 1954	Number 1972	Number Change 1954-1972	Percent Change 1954-1972
West Africa	2,326,206	2,535,500	209,294	8.99
Dahomey	48,620	39,200	-9,420	-19.37
Gambia	6,750	9,200	2,450	36.29
Ghana	164,140	172,300	8,160	4.97
Guinea	100,000	102,500	2,500	2.50
Ivory Coast	73,580	103,500	29,920	40.66
Liberia	25,760	27,600	1,840	7.14
Mali	106,140	143,100	36,960	34.82
Mauritania	21,250	27,600	6,350	29.88
Niger	200,960	94,300	-106,660	-53.07
Nigeria	1,308,300	1,450,000	141,700	10.83
Senegal	71,000	90,200	19,200	27.04
Sierra Leone	46,816	61,600	14,784	31.57
Togo	92,670	52,000	-22,330	-43.88
Upper Volta	123,220	162,400	39,180	31.79

TABLE 5  
INFANT MORTALITY

Country	Number 1954	Number 1972	Number Change 1954-1972	Percent Change 1954-1972
West Africa	523,134	529,335	620	1.18
Dahomey	11,107	21,277	10,170	91.56
Gambia	1,028	2,100	1,072	104.28
Ghana	35,216	55,046	19,830	56.30
Guinea	32,400	41,623	9,223	28.46
Ivory Coast	22,651	28,566	5,915	26.11
Liberia	13,340	27,065	13,725	102.88
Mali	65,415	50,350	-15,065	-23.02
Mauritania	7,862	7,233	-629	-8.00
Niger	65,312	31,553	-33,759	-51.68
Nigeria	179,648	168,200	-11,448	-6.37
Senegal	23,714	12,617	-11,097	-46.79
Sierra Leone	8,791	17,136	8,345	94.92
Togo	17,676	16,626	-1,050	-5.94
Upper Volta	38,969	49,940	10,971	28.15

TABLE 6

CHANGES IN NATURAL INCREASE FOR WEST AFRICA AND SELECTED WEST AFRICAN COUNTRIES, 1954-1972, BY NUMBER AND PERCENT

Country	Number 1954	Number 1972	Number Change 1954-1972	Percent Change 1954-1972
West Africa	1,562,539	2,654,200	1,091,661	69.86
Dahomey	52,360	100,800	48,440	92.51
Gambia	2,187	7,600	5,413	2.47
Ghana	124,520	278,900	154,380	123.98
Guinea	50,000	90,200	40,200	80.40
Ivory Coast	90,560	103,500	12,940	14.28
Liberia	20,240	32,400	12,160	60.07
Mali	117,120	121,900	4,780	4.08
Mauritania	21,250	25,200	3,950	18.58
Niger	125,600	118,900	-6,700	-5.33
Nigeria	710,220	1,450,000	939,780	104.16
Senegal	71,000	98,400	91,300	38.59
Sierra Leone	24,662	64,400	39,738	161.13
Togo	61,920	50,000	-11,920	-19.25
Upper Volta	90,900	112,000	21,100	23.21

## CHAPTER VI

### MULTIPLE REGRESSION ANALYSIS

This chapter reports the findings relative to objective two: to determine the socioeconomic measures of modernization that are associated with the changes in fertility, mortality and natural increase that transpired in West Africa from 1954 to 1972.

#### Unit of Analysis

Fourteen individually selected countries in West Africa were used as the unit of analysis. They were Dahomey, Gambia, Ghana, Guinea, Ivory Coast, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo, and Upper Volta.

#### The Research Hypothesis

Stated in null-form, the research hypothesis tested was: the set of independent variables  $X_1, X_2, X_3, \dots, X_7$  will not contribute significantly to the explanation of the variations observed in the dependent variables.

#### The Dependent Variables

The dependent variables were:

$Y_1$  = the absolute plus or minus change in the number of live births from 1954 to 1972

$Y_2$  = the absolute plus or minus change in the number of deaths from 1954 to 1972.

$Y_3$  = the absolute plus or minus change in the number of deaths occurring to children under one from 1954 to 1972.

$Y_4$  = the absolute plus or minus change in the natural increase from 1954 to 1972.

### The Independent Variables

The independent variables were the absolute plus or minus change from 1954 to 1972 in:

$X_1$  = Energy consumption

$X_2$  = Fertilizer consumption

$X_3$  = The economically active population engaged in agriculture.

$X_4$  = The rural population

$X_5$  = The urban population

$X_6$  = The total population

$X_7$  = The number of persons per physician.

### Multiple Regression Findings

The statistical findings are summarized in Table 7, with the significance level at .05.

### Changes in Fertility

Selection  $Y_1$ . The variation in  $X_6$  was found to contribute significantly to the variation observed in  $Y_1$ . Stated descriptively,

TABLE 7

SUM OF SQUARES AND PROPORTION OF VARIANCE ACCOUNTED FOR BY THE SIGNIFICANT INDEPENDENT VARIABLES (X) IN ORDER OF IMPORTANCE AS ENTERED INTO THE EQUATION, FOR EACH DEPENDENT VARIABLE SELECTION (Y).

Significant Independent Variable for Each Selection	Sum of Squares Accounted for	Proportion of Variation Explained	Cumulative Proportion of Variation Explained	Regression Coefficient for Significant Variables	Y-Intercept
Selection I (Y <sub>1</sub> )					
X <sub>6</sub>	708807557120.0	99.6	99.6	0.04314	-9450.37500
Selection II (Y <sub>2</sub> )					
X <sub>6</sub>	22245232640.0	66.6	66.6	0.05267	-10614.87500
X <sub>3</sub>	4397154304.0	13.2	79.7	0.01116	
X <sub>1</sub>	1360483840.0	4.1	83.8	0.04239	
X <sub>5</sub>	1279960832.0	3.8	87.6	-0.23738	
X <sub>2</sub>	761733056.0	2.3	89.9	3.72338	
X <sub>4</sub>	1835079168.0	5.5	95.4	0.16234	



Table 7. Continued

Significant Independent Variable for Each Selection	Sum of Squares Accounted for	Proportion of Variation Explained	Cumulative Proportion of Variation Explained	Regression Coefficient for Significant Variables	Y-Intercept
Selection III (Y <sub>3</sub> )					
X <sub>3</sub>	228846176.0	8.7	8.7	0.01372	6479.04297
X <sub>7</sub>	1024284672.0	39.2	47.9	0.22909	
X <sub>6</sub>	484902400.0	18.5	66.4	0.00714	
X <sub>5</sub>	324090624.0	12.4	78.8	-0.00481	
Selection IV (Y <sub>4</sub> )					
X <sub>6</sub>	474878312448.0	96.8	96.8	0.03531	-1256.00000

West African countries experiencing increased number of births from 1954 to 1972 were characterized by increased total population.

#### Changes in Mortality

Selection  $Y_2$ . The variations in  $X_6$ ,  $X_3$ ,  $X_1$ ,  $X_5$ ,  $X_2$  and  $X_4$  were found to contribute significantly to the variation observed in  $Y_2$ . Stated descriptively, West African countries experiencing increased number of deaths from 1954 to 1972 were characterized by:

- A. Increased total population
- B. Increases in the amount of economically active population engaged in agriculture.
- C. Increased energy consumption
- D. Lower urban population
- E. Greater rural population

#### Changes in Infant Mortality

Selection  $Y_3$ . The variations in  $X_3$ ,  $X_7$ ,  $X_6$  and  $X_5$  were found to contribute significantly to the variation observed in  $Y_3$ . Stated descriptively, West African countries experiencing increased infant mortality were characterized by:

- A. Increases in the amount of economically active population engaged in agriculture.
- B. Increased number of persons per physician
- C. Increased total population
- D. Increased urban population

### Changes in Natural Increases

Selection  $Y_3$ . The variation in  $X_6$  was found to contribute significantly to the variation observed in  $Y_3$ . Stated descriptively, West African countries experiencing higher levels of natural increases were characterized by increased total population.

## CHAPTER VII

### SUMMARY, CONCLUSIONS, IMPLICATIONS, LIMITATIONS AND RECOMMENDATIONS

#### Summary

With the expanding population in developing countries of the world, growing interest has emerged regarding the pattern of population growth in such countries, particularly as to whether or not population growth might not follow a transition pattern similar to that which occurred in industrialized western nations.

Because of this interest, this study investigated the following problem: What changes have transpired in West African countries in fertility, mortality and natural increase from 1954 to 1972 and how are these changes associated with social and economic measures of modernization?

Three objectives were formulated:

1. To determine the changes that have transpired in West African nations and West Africa as a whole in fertility, mortality and natural increase from 1954 to 1972.
2. To determine the social and economic measures of modernization that are associated with the changes in fertility, mortality and natural increase.

3. To evaluate the extent to which West Africa may be experiencing the process of demographic transition based on the findings.

Selected pertinent literature was reviewed and generalizations appropriate to the study were summarized from previous research.

Fourteen African nations were selected as the unit of analysis and appropriate variables were selected for analysis.

The independent variables were:

$X_1$ --Energy consumption

$X_2$ --Fertilizer consumption

$X_3$ --Economically active population in agriculture

$X_4$ --Rural population

$X_5$ --Urban population

$X_6$ --Total population

$X_7$ --Population per physician

The dependent variables were:

$Y_1$ --Births

$Y_2$ --Deaths

$Y_3$ --Infant deaths

$Y_4$ --Natural increase

The data were analyzed descriptively in order to determine the changes that had transpired in demographic processes and were reported in Chapter V.

The association between the independent variable and the four dependent variables was hypothesized in null-form and tested using multiple regression analysis.

#### Objective One: Conclusions and Implications

Objective One was to determine the changes that have transpired in West African nations and West Africa as a whole in fertility, mortality and natural increase from 1954 to 1972.

Four points are apparent in Objective One. The first is that the number of births, deaths, infant deaths and natural increase are increasing in West Africa as a whole. However, six countries experienced declines in infant deaths while three countries experienced decline in deaths. Natural increase grew to 69.86 percent.

The second point is that West African population is relatively young, since births experienced an increase of 33.45 percent.

The third point is that natural increase is high, rather than low, contrary to expectations, according to standardized demographic transition Stage I (High Potential Growth). This stage assumes that during this period high birth rates exist with fluctuating high death rates and fluctuating low natural increase. This suggests West Africa has advanced to the Transition stage.

The fourth is that Niger exhibited extreme declines in births, deaths, infant deaths and natural increase which may be

assumed to be an incorrect vital information by the Niger government.

Growth in the number of demographic events described above suggests that West African countries may expect additional rapid growth during this transition period, with increased demand for the kind of services and planning required for young populations.

#### Objective Two: Conclusions and Implications

Objective two was to determine the social and economic measures of modernization that are associated with changes in fertility, mortality and natural increase.

Empirical analysis showed six characteristics:

The increase in the number of births, deaths, infant deaths and natural increase was associated with total population increase in West Africa as a whole.

The increase in the number of deaths and infant deaths was associated with increase in the number of economically active population involved in agriculture.

More deaths appear associated with increases in energy and fertilizer consumptions.

Fewer deaths and infant deaths were experienced in Urban population: more deaths in rural population.

More infant deaths occurred due to fewer physicians in rural populations.

### Objective Three: Conclusions and Implications

Objective three was to evaluate the extent to which West Africa may be experiencing the process of demographic transition based on the findings.

The tables on the changes in fertility, mortality and natural increase suggest the number of births, deaths, infant deaths and natural increase are increasing in West Africa as a whole. However, six countries experienced declines in infant deaths and three countries experienced declines in deaths. Natural increase grew 69.86 percent. Based on the available data used, West Africa can be said to be on the verge of transition, but the transition may take a different demographic pattern because of her ideology and culture.

Empirical analyses of the social and economic measures of modernization that are associated with fertility, mortality and natural increase make difficult evaluating the extent to which West Africa as a whole may be experiencing the process of demographic transition. Demographic data are not complete for such evaluation. However, certain features are found. Increased energy consumption, as a measure of modernization, does not reduce mortality in West Africa, in that there were more deaths as the energy consumption increased. This feature is contrary to modernization transition concepts which state that energy consumption is associated with modernization. Nor does increased fertilizer consumption reduce mortality: there were more deaths when fertilizer consumption



increased. Again, this feature is contrary to agricultural transition concepts which state that fertilizer consumption is associated with modernized agriculture, which in turn is associated with demographic transition.

A second feature is that the number of births, deaths, infant deaths and natural increase grew while the total population experienced fewer deaths and fewer infant deaths, a feature of modernization in urban population. The low deaths and infant deaths in urban population are due to improved living standards. West Africa experienced greater natural increase due to increased number of live births.

With the available data used, it can be said that West Africa has started to experience some of the features of social and economic modernizations that are associated with demographic transition.

### Conclusion

This study has attempted to determine the changes that have transpired in West Africa fertility, mortality and natural increase, the social and economic measures of modernization that are associated with such changes and to evaluate the extent to which West Africa might be experiencing the process of demographic transition based on the findings.

In examining the changes that have transpired, West Africa cannot be said to be experiencing demographic change in terms of standardized demographic transition, because demographic data were

not complete to compare the change. Further, data regarding changes in rural, urban and total population were so inadequate to lead to improper calculation. (See Appendix I, Variables  $X_4$ ,  $X_5$  and  $X_6$ , where the number change values from 1954 to 1972 for the rural and urban portions of some of the nations are larger individually and/or jointly than the respective change values for the total population.) However, with the available data used, West Africa appeared to be following a different process from the standardized demographic pattern, in that natural increase was high while birth, deaths and infant deaths also increased. Nevertheless, six countries experienced decline in infant deaths and three countries experienced decline in deaths. This feature, coupled with increased births, could have contributed to the increase in natural increase.

With the available data used in testing the social and economic measures of modernization that are associated with fertility, mortality, and natural increase, Urban population experienced fewer deaths and fewer infant deaths, with the latter being the most sensitive index of modernization. Natural increase grew in number as a result of increased live births, which probably resulted from improved living conditions and medical availability in urban populations.

The relationship between energy and fertilizer consumption and population change does not make sense in case of West Africa.

In conclusion, West Africa is on the verge of transition, but the transition may take a different demographic pattern because of her ideology and culture.

West Africa has begun to experience some of the features of modernization that are associated with demographic transition.

### Implications

Increased numbers of births in West Africa generated young population. Increased births, declining infant deaths and deaths in Urban populations contributed to higher natural increases. Fewer medical doctors and medical services in rural populations contributed to greater infant deaths in West Africa.

West Africa has room for population expansion and adequate resources to care for her population only if her government can improve and utilize such resources.

Family planning should operate primarily on the basis of improving health of women, helping provide medical assistance to women, men and infants in rural populations and assisting those who want to limit their family sizes.

### Limitations

The limitations in this study were the difficulties of obtaining demographic data to compare the changes that had transpired in West Africa and to test the social and economic measures of modernization that are associated with such changes. Port Guinea and Cape Verde Island were eliminated from the study

because of lack of data. Miscalculations were generated due to data inadequacies.

### Recommendation

Further studies of population change in West Africa should investigate why greater deaths are associated with increased energy and fertilizer consumption.

The future studies of West Africa population change should concentrate on investigating what the immediate need of West Africa is and how these needs are to be met. By this statement is meant whether priority should be given to further death reduction or fertility restraint.

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Case No.	Subject	Reporting Agency	Date of Report
100-100000	...	...	...
100-100001	...	...	...
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100-100003	...	...	...
100-100004	...	...	...
100-100005	...	...	...
100-100006	...	...	...
100-100007	...	...	...
100-100008	...	...	...
100-100009	...	...	...
100-100010	...	...	...
100-100011	...	...	...
100-100012	...	...	...
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100-100018	...	...	...
100-100019	...	...	...
100-100020	...	...	...

APPENDIX I

DEPENDENT AND INDEPENDENT VARIABLES



VARIABLE ( $Y_1$ )

BIRTH NUMBERS, NUMBER CHANGES, PERCENT CHANGES IN  
WEST AFRICA AND BY COUNTRIES 1954 AND 1972

Country	Number 1954	Number 1972	Number Change 1954-1972	Percent Change 1954-1972
West Africa	3,888,745	5,189,700	1,300,955	33.45
Dahomey	100,980	140,000	39,020	38.64
Gambia	8,937	16,800	7,863	87.98
Ghana	288,660	451,200	162,540	56.30
Guinea	150,000	192,700	42,700	28.46
Ivory Coast	164,140	207,000	42,860	26.11
Liberia	46,000	60,000	14,000	30.43
Mali	223,260	265,000	41,740	18.69
Mauritania	42,500	52,800	10,300	24.23
Niger	326,560	213,200	-113,360	-34.71
Nigeria	2,018,520	2,900,000	881,480	43.66
Senegal	142,000	188,600	46,600	32.81
Sierra Leone	71,478	126,000	54,522	76.27
Togo	91,590	102,000	10,410	11.36
Upper Volta	214,120	274,400	60,280	28.15

VARIABLE (Y<sub>2</sub>)

DEATH NUMBERS, NUMBER CHANGES, PERCENT CHANGES IN  
WEST AFRICA AND BY COUNTRIES 1954 and 1972

Country	Number 1954	Number 1972	Number Change 1954-1972	Percent Change 1954-1972
West Africa	2,326,206	2,535,500	209,294	8.99
Dahomey	48,620	39,200	-9,420	-19.37
Gambia	6,750	9,200	2,450	36.29
Ghana	164,140	172,300	8,160	4.97
Guinea	100,000	102,500	2,500	2.50
Ivory Coast	73,580	103,500	29,920	40.66
Liberia	25,760	27,600	1,840	7.14
Mali	106,140	143,100	36,960	34.82
Mauritania	21,250	27,600	6,350	29.88
Niger	200,960	94,300	-106,660	-53.07
Nigeria	1,308,300	1,450,000	141,700	10.86
Senegal	71,000	90,200	19,200	27.04
Sierra Leone	46,816	61,600	14,784	31.57
Togo	92,670	52,000	22,330	43.88
Upper Volta	123,220	162,400	39,180	31.79

VARIABLE (Y<sub>3</sub>)INFANT MORTALITY NUMBERS, NUMBER CHANGES, PERCENT CHANGES IN  
WEST AFRICA AND BY COUNTRIES 1954 AND 1972

Country	Number 1954	Number 1972	Number Change 1954-1972	Percent Change 1954-1972
West Africa	523,134	529,335	620	1.18
Dahomey	11,107	21,277	10,170	91.56
Gambia	1,028	2,100	1,072	104.28
Ghana	35,216	55,046	19,830	56.30
Guinea	32,400	41,623	9,223	28.46
Ivory Coast	22,651	28,566	5,915	26.11
Liberia	13,340	27,065	13,725	102.88
Mali	65,415	50,350	-15,065	-23.02
Mauritania	7,862	7,233	-629	-8.00
Niger	65,312	31,553	-33,759	-51.68
Nigeria	179,648	168,200	-11,448	-6.37
Senegal	23,714	12,617	-11,097	-46.79
Sierra Leone	8,791	17,136	8,345	94.92
Togo	17,676	16,626	-1,050	-5.94
Upper Volta	38,969	49,940	10,971	28.15

VARIABLE (Y<sub>4</sub>)NATURAL INCREASE NUMBERS, NUMBER CHANGES, PERCENT CHANGES  
IN WEST AFRICA AND BY COUNTRIES 1954 and 1972

Country	Number 1954	Number 1972	Number Change 1954-1972	Percent Change 1954-1972
West Africa	1,562,539	2,654,200	1,091,661	69.86
Dahomey	52,360	100,800	48,440	92.51
Gambia	2,187	7,600	5,413	2.47
Ghana	124,520	278,900	154,380	123.98
Guinea	50,000	90,200	40,200	80.40
Ivory Coast	90,560	103,500	12,940	14.28
Liberia	20,240	32,400	12,160	60.07
Mali	117,120	121,900	4,780	4.08
Mauritania	21,250	25,200	3,950	18.58
Niger	125,600	118,900	-6,700	-5.33
Nigeria	710,220	1,450,000	939,780	104.16
Senegal	71,000	98,400	91,300	38.59
Sierra Leone	24,662	64,400	39,738	161.13
Togo	61,920	50,000	-11,920	-19.25
Upper Volta	90,900	112,000	21,100	23.21

VARIABLE X<sub>1</sub>

Country	Energy Consumption (in Million Metric Tons)		Change 1954-1972
	1954	1972	
Dahomey	50,000	10,000	50,000
Gambia	10,000	30,000	20,000
Ghana	610,000	1,650,000	1,040,000
Guinea	80,000	430,000	350,000
Ivory Coast	260,000	1,170,000	910,000
Liberia	70,000	580,000	510,000
Mali	50,000	130,000	80,000
Mauritania	20,000	160,000	140,000
Niger	10,000	90,000	80,000
Nigeria	1,500,000	3,330,000	1,830,000
Senegal	340,000	520,000	180,000
Sierra Leone	130,000	280,000	150,000
Togo	30,000	150,000	120,000
Upper Volta	30,000	70,000	40,000

## VARIABLE X

Fertilizer Consumption (in 100 Metric Tons)			
Country	1954	1972	Change 1954-1972
Dahomey	600	5,300	4,700
Gambia	400	500	100
Ghana	1,900	6,355	4,455
Guinea	1,100	3,300	2,200
Ivory Coast	6,600	23,300	19,700
Liberia	300	1,100	800
Mali	1,500	7,200	5,700
Mauritania	200	300	100
Niger	100	108	8
Nigeria	2,800	22,900	20,100
Senegal	200	10,166	9,966
Sierra Leone	600	2,600	2,000
Togo	200	487	287
Upper Volta	200	500	300

VARIABLE X<sub>3</sub>

Country	Economically Active Population in Agriculture 1954	Economically Active Population in Agriculture 1972	Change 1954-1972
Dahomey	845,000	689,000	-156,000
Gambia	120,000	159,000	39,000
Ghana	1,770,000	1,914,000	144,000
Guinea	1,465,000	1,561,000	96,000
Ivory Coast	1,550,000	1,866,000	316,000
Liberia	340,000	353,000	13,000
Mali	1,935,000	2,595,000	66,000
Mauritania	345,000	311,000	-34,000
Niger	1,365,000	1,112,000	-253,000
Nigeria	20,530,000	15,098,000	-5,432,000
Senegal	10,090,000	1,314,000	224,000
Sierra Leone	850,000	768,000	-82,000
Togo	555,000	599,000	44,000
Upper Volta	1,825,000	2,661,000	836,000

VARIABLE X<sub>4</sub>

Country	Rural Population 1954	Rural Population 1972	Change 1954-1972
Dahomey	358,000	2,328,000	1,970,000
Gambia	36,000	328,000	292,000
Ghana	2,820,000	6,206,000	3,386,000
Guinea	437,000	3,484,000	3,047,000
Ivory Coast	915,000	3,395,000	2,480,000
Liberia	75,000	1,053,000	978,000
Mali	609,000	4,479,000	3,870,000
Mauritania	86,000	1,085,000	999,000
Niger	315,000	3,533,000	3,218,000
Nigeria	12,535,000	42,539,000	30,004,000
Senegal	1,021,000	2,904,000	1,883,000
Sierra Leone	366,000	2,278,000	1,912,000
Togo	248,000	1,613,000	1,365,000
Upper Volta	200,000	5,176,000	4,976,000



VARIABLE X<sub>5</sub>

Country	Urban Population 1954	Urban Population 1972	1954-1972
Dahomey	97,000	1,635,000	1,538,000
Gambia	19,000	237,000	218,000
Ghana	848,000	4,176,000	3,328,000
Guinea	119,000	2,568,000	2,449,000
Ivory Coast	197,000	2,625,000	2,428,000
Liberia	49,000	829,000	780,000
Mali	272,000	3,154,000	2,882,000
Mauritania	31,000	765,000	734,000
Niger	92,000	2,199,000	2,107,000
Nigeria	4,742,000	29,589,000	24,847,000
Senegal	492,000	2,108,000	1,616,000
Sierra Leone	175,000	1,604,000	1,429,000
Togo	65,000	1,136,000	1,071,000
Upper Volta	75,000	3,694,000	3,619,000

## VARIABLE X6

Country	Total Population 1954	Total Population 1972	Change 1954-1972
Dahomey	1,870,000	2,800,000	930,000
Gambia	270,000	400,000	130,000
Ghana	5,660,000	9,600,000	3,940,000
Guinea	2,500,000	4,100,000	1,600,000
Ivory Coast	2,830,000	4,500,000	1,670,000
Liberia	920,000	1,200,000	280,000
Mali	3,660,000	5,300,000	1,640,000
Mauritania	850,000	1,200,000	350,000
Niger	6,280,000	4,100,000	-2,180,000
Nigeria	37,380,000	58,000,000	20,620,000
Senegal	2,840,000	4,100,000	1,260,000
Sierra Leone	2,090,000	2,800,000	710,000
Togo	1,290,000	2,000,000	710,000
Upper Volta	4,040,000	5,600,000	1,560,000

VARIABLE X<sub>7</sub>

Country	Population Per Physician 1954	Population Per Physician 1972	Change 1954-1972
Dahomey	50,000	32,024	17,976
Gambia	27,058	18,947	-8,111
Ghana	31,343	12,392	-19,951
Guinea	47,650	49,740	2,090
Ivory Coast	3,000	138,559	13,559
Liberia	15,161	10,455	-4,706
Mali	95,609	41,452	-54,157
Mauritania	6,831	17,206	10,375
Niger	102,538	56,667	-45,871
Nigeria	46,899	20,526	-26,373
Senegal	70,640	14,943	-55,697
Sierra Leone	29,666	17,114	-12,552
Togo	96,000	29,706	-66,294
Upper Volta	120,555	92,759	-27,796



## MEAN AND STANDARD DEVIATION FOR VARIABLES

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Variable	Mean	Standard Deviation
Y <sub>1</sub>	92925.31250	233955.87500
Y <sub>2</sub>	14949.57031	50702.58984
Y <sub>3</sub>	443.07129	14185.05859
Y <sub>4</sub>	82540.06250	194267.75000
X <sub>1</sub>	392857.12500	525259.93750
X <sub>2</sub>	5029.71094	6913.45703
X <sub>3</sub>	-298500.00000	*****
X <sub>4</sub>	4312856.00000	*****
X <sub>5</sub>	3503283.00000	*****
X <sub>6</sub>	2372857.00000	*****
X <sub>7</sub>	-8840.14063	47560.83594

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## CORRELATION MATRIX

	$Y_1$	$Y_2$	$Y_3$	$Y_4$	$X_1$
$Y_1$	1.00000	0.81606	0.05609	0.98630	0.84517
$Y_2$	0.81606		0.20703	0.72391	0.63378
$Y_3$	-0.05609	0.20703		-0.14216	0.09240
$Y_4$	0.98630	0.72391	-0.14216		0.84217
$X_1$	0.84517	0.63378	0.09240	0.84217	
$X_2$	0.65938	0.62186	-0.12109	0.64986	0.75635
$X_3$	-0.93752	-0.63602	0.29578	-0.95423	-0.75980
$X_4$	0.96540	0.71548	-0.25000	0.96770	0.78719
$X_5$	0.97391	0.72760	-0.22571	0.97530	0.81141
$X_6$	0.99806	0.81586	-0.07774	0.98383	0.85344
$X_7$	0.81891	0.60443	0.12282	0.80354	0.75149

## CORRELATION MATRIX (Continued)

$X_2$	$X_3$	$X_4$	$X_5$	$X_6$	$X_7$
0.65938	-0.93752	0.96540	0.97391	0.99806	0.81891
0.62186	-0.63602	0.71548	0.72760	0.81586	0.60443
-0.12109	0.29578	-0.25000	-0.22571	-0.07774	0.12282
0.64986	-0.95423	0.96770	0.97530	0.98383	0.80354
0.75635	-0.75980	0.78719	0.81141	0.85344	0.75149
	-0.58684	0.63288	0.65337	0.67837	0.58818
-0.58684		-0.95556	-0.95676	-0.93603	-0.81391
0.63288	-0.95556		0.99893	0.97001	0.78147
0.65337	-0.95676	0.99893		0.97857	0.79145
0.67837	-0.93603	0.97001	0.97857		0.80999
0.58818	-0.81391	0.78147	0.79145	0.80999	

APPENDIX III

MAP OF WEST AFRICA





# MAP OF WEST AFRICA

