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LANDHOLDING AND HUMAN FERTILITY IN RWANDA

BY

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ABSTRACT

LANDHOLDING AND HUMAN FERTILITY IN RWANDA

By

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There are two schools of thought regarding the importance of landholding in the family planning decisions of farm couples. One side argues that farmers with large holdings have many children in order to meet their demand for farm labor (land-labor demand hypothesis). By contrast, others assert that land is a substitute for old age social and economic security provided by children, and therefore exerts a negative effect on fertility behavior (the land-security hypothesis). Survey data derived from 1019 farm households in Rwanda are used to examine these alternative hypotheses. The opinions held by parents and their children regarding childbearing and landholding in this land-scarce, subsistence economy are taken into account.

This analysis supports the notion that number of children increases with size of landholdings. The hypothesis that landholdings substitute for children in the provision of old age security is not supported. The data also show that age of husband and wife, and the husband's migration for

employment exert a positive effect on size of families while wife's age at marriage and wife's education are negatively associated with number of living children. Female participation in the labor force and husband's education are virtually unrelated to fertility patterns.

Further, it is observed that although fertility rates are very high among these Rwanda respondents, they recommend even larger families for their children! However, the younger generation, particularly young women, seem to be influenced by new demands on their time and have begun to show interest in using contraceptives to limit the number of children they have.

Dedication

Dedicated with love and respect to my mother who symbolizes the "inter-generational wealth flow from parents to children".

Acknowledgements

When I look back at the five years since I first arrived at Michigan State University in 1986, I find a long list of friends, colleagues, faculty and students who assisted me in my academic and intellectual development, and who always helped me feel that I was a part of this society. It is almost impossible to thank each one of them by name. Thus, I take this opportunity to offer my collective thanks, from the bottom of my heart, to each and every one of them.

Professor Alan Beegle stands at the top of the list of those who I wish to thank individually. I was extremely fortunate to have professor Beegle as my advisor. This classical scholar of demography and rural sociology has spent almost half a century dedicating himself to teaching and other creative work. From the very first day of my arrival in the department he has been a source of love, affection, and comfort for me. As a teacher and a scholar I have always looked to him as a role model. My feeling of appreciation and affections toward Professor Beegle cannot be captured in words.

I don't remember when I first met Dr. Dan Clay. It seems as though we have worked together always. This young scholar, who holds for all of his students only the highest

of standards, volunteered to devote his time to directing my dissertation in spite of a daunting list of competing obligations. Learning from him has been a multi-dimensional experience for me. I have learned from him not only as a teacher and a scholar but also as a person. I am deeply struck by the level of hard work, devotion, thoughtfulness, organization, and clarity, he maintains as a teacher. His open door policy, smiling face, patience, and willingness to go out of his way to help others are among the long list of unique qualities he possesses, and which sadly seem to be disappearing in this industrialized world. More to the point, he has devoted literally months and months of time to my training as young sociologist, in virtually every aspect of profession (theory construction, research design, data processing and manipulation, data analysis and techniques of professional writing and presentation are among the first that come to mind). He not only helped me develop theses basic skills but consistently struggled to refine and polish my logical thinking as a sociologist. I have had the opportunity to make abundant use of these skills both in working through my dissertation, and in my role as a teacher here at Michigan State University. I will owe him a debt of gratitude for the rest of my life.

I believe that Professors Harry Schwarzweller, Jay Artis, Tom Conner, Marvin Olsen, Martin Marger, and Chris Vanderpool are among the very finest teachers at this

university. They have always been a source of wisdom for me. They have contributed profoundly to my future as a sociologist and have likewise played a significant role in all of my achievements here at MSU. I could write endless pages about them as scholars, teachers, and individuals, but will summarize here just by saying thanks for all you have given me.

I also wish to give special thanks to the department of sociology, and to Michigan State University where I have been given every opportunity for achievement. Like many of my fellow graduate students, I have never struggled financially through the course of my studies. In fact, I have always had more than enough resources, coming from various teaching and research assignments, to carry me through. MSU is truly an institution that provides equal opportunity to all students.

Finally, many thanks to those in the Government of Rwanda who permitted me to use their data for this study.

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CHAPTER 1

INTRODUCTION

It took more than 1,800 years for the world's population to increase from 210 million to one billion. The second billion required about a century and a quarter, and the third only thirty years. This rapid increase in population has affected all regions of the world, including Africa (World Bank, 1972). Since the end of the Second World War, Africa's population has grown rapidly as a result of high fertility and declining mortality. In 1950, the population of the continent was about 220 million. By 1979 it had increased to 458 million (United Nations, 1985) and in 1990 it has reached 661 million. With the current rate of natural increase at 2.9, this population will double in size over the next 24 years (Haub and Kent, 1990).

At the World Population Conference held in 1974 the United Nations and various other international agencies and national governments agreed on the proposition that "population and development are interrelated" (Stamper, 1977). At the end of the conference a World Population Plan of Action was adopted. Following the direction of the United Nations, widespread family planning programs were adopted by

many developing countries. The current decline in population growth in many developing countries can be at least partially attributed to the efforts of their family planning programs. However, the rate of population growth in Africa has remained relatively unchanged. In fact, the growth rate of the African population actually accelerated from 2.8 percent a year for the period 1970-82 to 2.9 percent a year in 1990, the highest of any region in the world (Haub and Kent, 1990).

Social scientists have been struggling for decades to identify and understand the factors that influence the fertility behavior of individuals and to reinforce the implementation of family planning programs. One of the most fundamental, yet least understood, determinants of fertility is that of landholding. Previous research on the relationship between land and fertility has produced mixed findings. On one hand, it is argued that landholding has a positive effect on fertility because it increases the household demand for labor. On the other hand, some evidence suggests that land provides old-age security in the absence of any system of formal or informal social security via children in developing countries, thereby reducing the number of children that parents have. Completed fertility is the product of these competing effects. Little demographic research, and virtually none in Africa, has attempted to identify the mechanisms through which, and conditions under which these competing influences are transmitted.

The purpose of the present study is to examine the relationship between landholding and fertility in the geographically small and densely populated agrarian country of Rwanda. This is an especially relevant topic to Rwanda, for the country has experienced a virtual explosion of population during the past two decades. In 1949 the population of Rwanda was estimated at 1.8 million; it increased to 2.4 million in 1956, with a very high density of 235.8 inhabitants per square mile (Maquet, 1961). By January 1, 1966 it was estimated to be 3 million (Government of Rwanda, 1967) and currently is 7.3 million. In effect, the population has more than doubled over the past twenty- three years. Rwanda's current fertility rate of 8.3 is the highest in the world, and translates into a rate of natural increase of 3.4. If this rate persists the population will again double over the next twenty years (Haub and Kent, 1990).

Rules governing access to land in Rwanda are shaped by traditional norms and the written laws introduced by colonial powers. The traditional land tenure system maintained by the Hutu ethnic group was characterized by a collective tenure system (Ubukonde) in which land was owned by the tribe or clan which arrived there first (Blarel, 1990). When the Tutsi ethnic group came into power, they abolished the traditional Ubukonde system and granted the authority to allocate land according to the political decisions of their chief. Moreover, they imposed sundry

taxes on land users. The land tenure system went through various changes during the Belgian rule, and then again after the independence. At present there is registered and non-registered land. Non-registered land belongs to the state with the use right of individuals. Registered land is owned by the traditional owners.

As a result of rapid population growth and the sub-division of family farms among children, the average farm size has shrunk in Rwanda. In a recent unpublished research report, Olson (1990) observes that the average farm size in Rwanda is 1.2 hectares (with an average as little as .70 hectares for some prefectures) which is less than half of the average size in 1965. Both parents and children realize the consequences of a small farm, and in turn embark upon alternative strategies such as: 1) buying or renting in land, 2) migrating to other regions, or 3) seeking non-agricultural employment. These strategies, however, do not seem to be successful in coping with the current rate of population growth.

Scarcity of land, rapid population growth, and high population density alarmed the policy makers of Rwanda in 1974 and led to the creation of Advisory Scientific Council for socio-demographic problems. However, it was not until 1981 that the National Office of Population (ONAPO) was established. The main concern of ONAPO is to examine the socio-economic implications of population growth and to

implement the country's family planning program. Various international donor agencies continue to provide both financial and technical support to this program.

As mentioned above, the total fertility rate in Rwanda is 8.3 which translates into a rate of natural increase of 3.4 percent. These high rates suggest that like many other developing countries the achievements of family planning programs in Rwanda have been less than successful. One of the principal failures of family planning programs, as suggested in the literature, is their introduction without concomitant structural changes in society. Structural determinants of high fertility for most developing countries have roots in socio-cultural, religious, economic, and political institutions. Agriculture, which is the sole livelihood of rural people in many developing countries, naturally has a strong influence on all of these institutions.

There has been extensive research on the structural determinants of fertility during the past three decades. The foundation for this research was laid by Thomas Malthus in the 19th century, and by Frank Notestein and Kingsley Davis in the mid-twentieth century with the introduction of demographic transition theory. This theory emphasizes economic development as a structural determinant of fertility, suggesting that economic development leads to an improved standard of living, better nutrition, and health

facilities. As a result, mortality rates decline, leading to an acceleration in population growth. When these societies experience high levels of modernization the costs associated with childbearing and child-rearing, make smaller families economically advantageous. Therefore, modern societies experience both low fertility and low mortality.

Demographic transition theory has stimulated much thought and research on the structural determinants of fertility. Empirical research from all over the world suggests that industrialization, socioeconomic development, modernization, participation of women in industrial labor force, education, income, and various other structural determinants, all shape the fertility behavior of women. However, one of the more important structural determinants of fertility, that has received inadequate attention from sociologists and demographers is the nature of landholding. Land provides the sole livelihood to an overwhelming majority of rural residents in the developing world. Size of landholdings, the topography and quality of the land, land rights, and all other such characteristics of landholdings have a direct influence on the fertility behavior of rural people.

Empirical evidence from Rwanda on the relevance of landholding in shaping the fertility behavior of rural couples is available from the 1988 "Non-farm Strategies Survey," conducted jointly by the Government of Rwanda and

the Agency for International Development (AID). The main objective of the survey was to examine the strategies employed by farm families in Rwanda to overcome the constraints of limited resources and rapid population growth (Clay, 1988). Questions were directed to husbands, wives, and adult children living with parents in a sample of 1,019 households. Topics covered in the questionnaire included: a) demographic characteristics of all household members, including migrant children, b) non-farm and off-farm employment of all households members, c) permanent and temporary migration patterns of selected household members, d) fertility behavior, e) plans and preferences of all adult household members regarding access to land and family size, f) economic support networks between the household and members of the extended family living elsewhere, g) sources of household income, h) physical characteristics of the farm and residence, i) hired farm labor, j) aspirations and opinions of parents and adult children regarding non-farm training and employment, and k) opinions on desired number of children by parents and children, recommended number of children to next generation by parents, and the problems created by overpopulation.

By examining the direct and indirect effect of landholdings on fertility in Rwanda, this study should provide insights to policy makers relevant to formulating population policy. It will also provide a scientific basis

for evaluating the fertility consequences of policies addressing land reform, inheritance laws, and women's rights to land. The opinions of parents and children on the issues of scarcity of land, overpopulation, desired and recommended number of children which were assessed in the survey, will provide a sounding on how rural people of Rwanda perceive these problems.

CHAPTER 2

SOCIO-HISTORICAL SETTING

Socio-Historical Background

The population of Rwanda is comprised of three ethnic groups: the Hutu (85%), the Tutsi (14%), and the Twa (1%). An historical account of the settlement of these groups in Rwanda cannot be found in archival records, but is known only through traditional knowledge (Nenquin, 1967). Twentieth century literature, however, suggests that the first ethnic group to occupy the territory now known as Rwanda were the Twa. They were forest dwellers and did not live a settled life. Their subsistence was derived from hunting and food gathering; they were also skilled in pottery-making. Hutu were the next to join them and it is believed that they migrated primarily from the west as part of the larger Bantu migration. Traditionally, Hutus are hoe cultivators. The third ethnic group, the Tutsi is reported to have made its way to the region in the 14th Century. Tutsi, in contrast to other ethnic groups, derived their livelihood from cattle raising and herding. Tutsi migration seems to have been gradual and peaceful, an infiltration rather than a conquest. Arriving with herds of cattle, the Tutsi adapted slowly to local conditions and dominated the

other ethnic groups, claiming it was their divine right (Maquet, 1961). This domination was visible in the socio-economic and political institutions of Rwanda even during the period of German and Belgian rule. Both colonialists used this ethnic elite group to rule the country. Political independence, however, broke this traditional pattern of minority rule over the Hutu majority and replaced it with a more democratic political and economic system. Accordingly, representation of the Hutu in the country's socio-economic and political organizations became more significant (Codere, 1973; Nenquin, 1967; Lemarchand, 1970). However, the rivalry between these ethnic groups has continued since independence, and has flared up on a number of occasions over the past three decades.

The period of foreign rule experienced by Rwanda was little more than half a century. Foreign interventions were established by the Germans in the Declaration of Council of Berlin that Rwanda was an area of their interest. The first German military post was established in Rwanda in 1907. As a result of World War I, the area was placed under Belgian rule in 1916. In 1929 in response to a period of severe famine in Rwanda, the daughter of the king of Rwanda revolted against Belgium. The revolt was crushed by the brutal force of Belgian army and no significant resistance took place for a long time after this incident (James, 1969). Belgians

remained in power until July 1, 1962 when Rwanda became an independent state.

Although the three ethnic groups of Rwanda have different origins and have not yet overcome their political differences, they still speak the same language, practice the same religions (Traditional, Christianity, and Islam), and hold many of the same traditional values. More children, for example, are considered to be a symbol of strength and prosperity in Rwanda regardless of one's ethnicity.

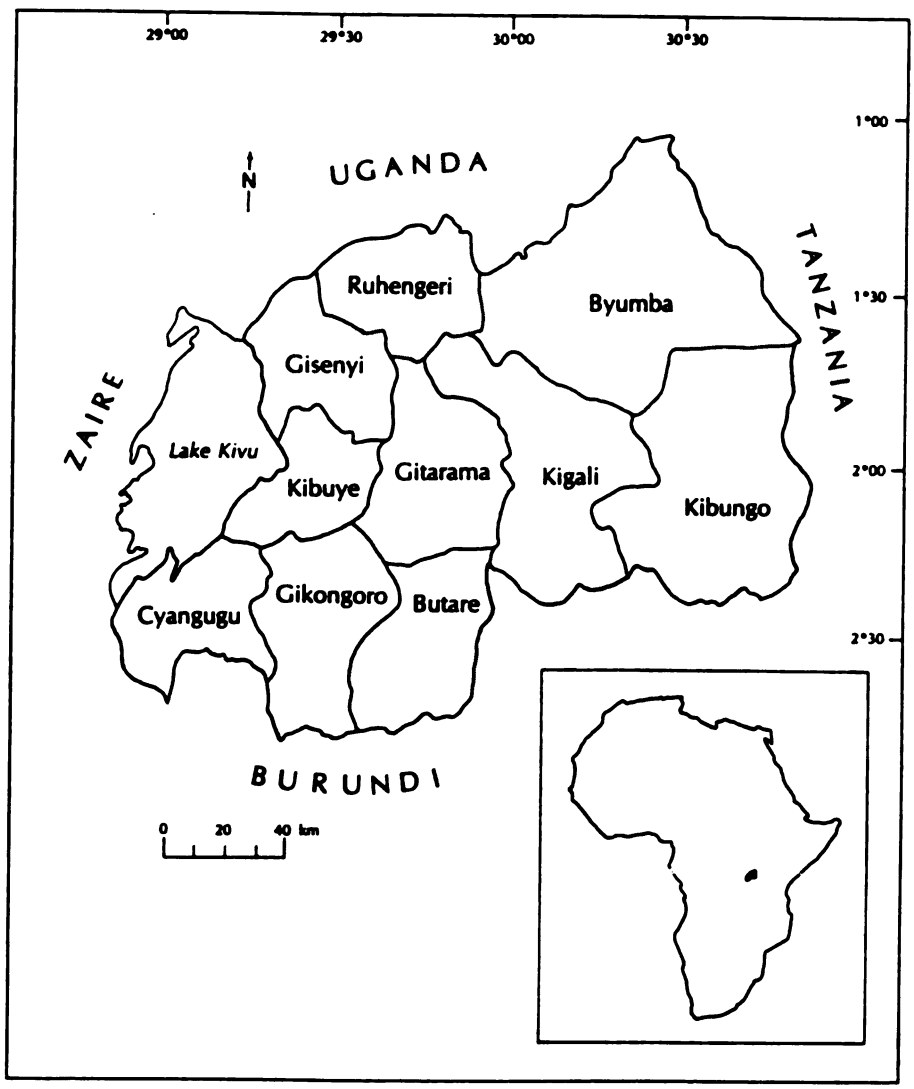
The present culture of Rwanda, therefore, is shaped by the various aspects of three indigenous cultures, the western colonialists, influences of various immigrants from other parts of Africa, and by the impact of waves of modern western cultures through travel, diplomatic relations, and other channels of communication.

Geography

Geographically Rwanda is a landlocked country, covering 10,186 square miles, and is located south of the equator in the East African Highlands where it is surrounded by Tanzania, Burundi, Zaire and Uganda. The topography is very hilly, rocky, and volcanic. Lake Kivu and a volcanic mountain range also occupy much of its border with Zaire to the North and West (see map on next page).

Figure 1

The Republic of Rwanda



Hills, mountains, numerous lakes, and marshes remove a considerable amount of land from tillage in Rwanda. According to official surveys only 70.4% of the total land area of 10,168 square miles is available for agriculture. Out of this available land, only 43.6 percent is suitable for cultivation (Nyrop, 1985). That which remains is either in forest or is being used for pasture. Thus, access to land by the farm population is very limited, and as a result the country is densely inhibited. Average farm holdings are 1.21 hectares, a fraction of the size of holdings found in other countries in the region and on the other continents. Among other problems, this shortage of arable land has become a barrier to the mechanization of agriculture, high productivity, and desirable economic growth.

There are four climatic seasons in Rwanda, each corresponding to a particular set of agricultural activities. Two rainy seasons (September-December and February-May) are sowing seasons and the two dry seasons are when crops are harvested and land is cleared.

Land degradation occurs in Rwanda for both natural and man made reasons. Natural degradation comes primarily through heavy rainfall on steep highland slopes. However, degradation is also a result of overpopulation, which has pushed farmers on to fragile, less productive land for a livelihood. Moreover, overpopulation has forced Rwanda farmers to use their land intensively to cope with the

country's higher demand for food, leaving behind minimum pasture and fallow land (Clay and Lewis, 1989).

Economy of Rwanda

The economy of Rwanda is primarily dependent on subsistence agriculture, the main crops being sorghum, beans, peas, sweet potatoes, corn, cassava, and bananas. The main cash crop is coffee. Tea is also grown for export. Cattle raising is another significant economic activity of the rural population. Livestock not only elevates the socio-economic status of the household in rural Rwanda, but it plays a significant role in the national economy as well. Livestock has become more significant as a result of rapid population growth. There is a growing demand for meat in urban areas, emerging international meat trade, and improved local infrastructure for livestock production (Rwamasirabo, 1990).

Virtually all agricultural tasks are accomplished with the aid of simple hand implements. In this highly labor-intensive agricultural system, the use of hoes is very common and animal traction and motorized equipment are very uncommon (Clay, 1987; Nyrop et al., 1985). According to a report published by the Rwanda Ministry of Agriculture, Livestock, and Forests (SESA, 1987), men, women, and children all play a significant role in agricultural tasks in this country. The report suggests that the role of women is more important than that of men in almost all phases of

agriculture including, sowing and planting, weeding, harvesting, and post-harvest activities. Males in Rwanda tend to dominate marketing. With the exception of purchasing for inputs, men are responsible for buying livestock, products for animals, seeds, and agricultural machinery. The sales of livestock, certain agricultural products, animal products, and beer are also controlled by men.

As mentioned earlier, livestock plays an important role in the economy of Rwanda. Although men and women seem to provide equal labor for this industry, children play the most important role in grazing and herding. Table 1 suggests that labor provided by children is 60.4% for cattle, 52.0% for pigs, 47.1% for goats, and 39.4% for sheep. This labor is in addition to the labor they provide in other agricultural activities.

The division of labor, as reported in the above paragraphs, signifies the important role played by men, women, and children in the rural economy of Rwanda. It appears that children in this economy are not a burden but rather they are an economic asset through the labor they provide, leading to an intergenerational flow of wealth from children to parents (Clay and Vander Haar, 1992), which according to Caldwell's theory of fertility decline (Caldwell, 1976; 1982) enhances fertility.

Although agriculture is still the backbone of Rwanda's economy, there is some development in occupations

Table 1. Division of Labor in Responsibility for Livestock

Persons Responsible	Cattle	Pigs	Goats	Sheep
Men	27.1	25.0	22.4	14.9
Women	2.8	23.0	28.4	45.5
Children	46.3	49.6	39.3	35.7
Hired Labor (men)	9.7	0.0	2.5	0.2
Hired Labor (children)	14.1	2.4	7.8	3.7
Total	100.0	100.0	100.0	100.0
(N=)	(469)	(134)	(319)	(693)

Source: SESA (1987)

like manufacturing, processing, construction, transport, commerce and trade, and government service. Forty seven percent of all rural households receive some income from the non-farm sector (Clay et al. 1989). The manufacturing sector in Rwanda is dominated by consumer goods industries including beer, soft drinks, sugar, cigarettes, matches, soap, plastic shoes, and blankets (EIU, 1986). These industries depend on imported fuel which comes from the Mombasa Refinery in Kenya. France is helping Rwanda to expand its own storage capacity for petroleum which might accelerate industrial growth. Buses, trucks, and cars for private and public use are being imported from Japan, Europe, and elsewhere.

Per capita GNP is only $300 which places Rwanda among the poorest nations in the world. Average annual growth of industrialization is as low as 4.8 percent. The major sources of exports are cash crops and some minerals (primarily tin) which brings in only 121 million dollars in foreign exchange. On the other hand, each year this nation is forced to import an average of 11 million metric tons of cereals, fuel, machinery and transport equipment, and other manufactured goods on which it spends 352 million dollars. To bridge the gap it has to depend upon foreign loans and aid. In 1987, for example, the total unpaid debt was 583 million dollars and is on the increase (World Bank, 1989).

The poor economy has a direct effect on every aspect of daily life in Rwanda. Access to basic needs such as potable water, food, health care, and schooling is severely limited. As a result, Rwanda is characterized by poor health, under-nourished children, high infant mortality, low rates of school enrollment, and low life expectancy.

CHAPTER 3

CONTROLLING POPULATION GROWTH IN RWANDA

Realizing the dangers of rapid population growth, many sub-Saharan countries had established their family planning programs by the end of 1960s. By the end of 1970s more than 27 countries had implemented explicit family planning programs. But It was not until 1981 that Rwanda officially initiated its family planning program (United Nations, 1985).

Prior to the adoption of a national family planning program, the Department of Social Affairs expressed its concern over the high density and high rate of population growth. National and international migration was thought by some to be the best solution. However, in 1974 the Rwanda government created an Advisory Scientific Council for socio-demographic problems, which strongly recommended the establishment of national family planning program, and also pointed out the impracticality of national and international migration as a remedy to the problem of overpopulation (Population Council, 1977). It was not until six year later that the government actually adopted these recommendations.

Realizing the severe implications of rapid population growth, the government in 1981, established the National Office of Population (ONAPO). This institution was

part of the Ministry of Health and it was assigned the following tasks (May, 1990):

1. Examination of socio-economic implications of population growth.
2. Warn the people about the consequences of overpopulation through information, training, and education without interfering with the freedom of religious and moral convictions.
3. Proper deployment of family planning methods.
4. Integration of the family planning program into the general health program.
5. Prepare a plan to achieve a balance between production and demographic growth.
6. Development of educational programs at all levels to achieve awareness about population issues.

In 1986 the Rwandan Association for Family Welfare (ARBEF) was created by the International Planned Parenthood Federation to join ongoing government efforts to lower fertility in the country. For the past nine years these national and international organizations have been struggling to lower fertility in Rwanda under the framework developed by the government as mentioned above. More specifically, the sequential scheme eventually adopted goes as follows: a) creating awareness, b) providing contraceptives, c) offering family planning services in the medical centers, and d)

conducting operations research in the area of family planning (May, 1990).

At the present time the achievements of Rwanda's family planning program seem to be relatively few as reflected in Table 2.

The data in Table 2 show that over the past fifteen years the birth rate in Rwanda has not declined. The death rate, on the other hand, has declined, and as a result of these divergent trends the rate of natural increase has increased markedly (from 2.6 to 3.4), which if sustained will double the size of the population over the next 17 years.

Table 2. Demographic Indicators in Rwanda Before and After the Introduction of a Family Planning Program (FPP).

	Before FPP		After FPP	
Demographic Indicators	**1975**	**1980**	**1985**	**1990**
Birth Rate	50.0	50.0	53.0	51.0
Death Rate	24.0	19.0	17.0	17.0
Rate of Natural Increase	2.6	3.0	3.6	3.4
Total Fertility Rate	8.7	6.9	7.3	8.3
Total Population (million)	4.2	5.1	6.3	7.3
Population Doubling Time	27.0	23.0	17.0	17.0

Source: Population Reference Bureau's Data Sheets (1975-90)

Total fertility rates show some fluctuation but remain high overall: the current rate being the highest in the world and higher than in the neighboring African countries with similar socio-economic characteristics (Nicholas et al., 1984; World Bank, 1986).

Barriers to Family Planning in Rwanda

Insignificant achievements of Rwanda's family planning programs can be attributed to two main factors, namely, 1) strong socio-cultural resistance and 2) a poor strategy for implementation of the program. Since the emphasis of this research is on the structural determinants of high fertility, and it is intended to evaluate these factors in detail in the following chapters, only a brief overview of these factors as they pertain to the Sub-Saharan and Rwandan contexts is presented here. In addition, some reference is also made here regarding strategies employed in the implementations of Rwanda's family planning program.

Most African countries have traditionally taken a pro-natalist stand on family planning issues. One result of these pro-natalist attitudes is that in many African nations the importation, manufacture, advertisement, and sale of contraceptives was prohibited (Caldwell, 1969; Wolf, 1973). Over time these laws have changed but they still suffer from the residual effects.

These pro-natalist laws were generated on the bases of existing social forces in favor of higher fertility in African societies. The same social forces are acting as barriers to current family planning programs in the region. In general these barriers can be grouped as socio-cultural, religious, economic, medical, and administrative. The following sections discuss how these barriers continue to act as a negative force against family planning programs in Rwanda.

Socio-cultural forces: Rwanda like many other developing countries is characterized by a joint family system, strong ethnic identification, traditional gender roles, a low literacy rate, and emotional and financial support for the elderly by children. These social conditions tend to enhance fertility and interfere with the possible use of contraceptives by women.

Religious forces: Religion all over the world plays a significant role in shaping the attitudes of people toward desired number of children. All of the great religions in the world, including Confucianism, Buddhism, Hinduism, Judaism, Christianity, and Islam encourage large families and contain specific divine verses praising those who have large numbers of children (Caldwell, 1987). Further, there are anti-family planning messages in most of

these religions. The Middle East, Africa, and most parts of Asia are dominated by these religious forces which openly declare family planning practices as evil.

The population of Rwanda consists of 74% Catholics, 25% traditional religion, and 1% Muslims. In fact traditional religion still prevails in some form among nearly the entire population of Rwanda. Both traditional and new religions promote higher fertility. The common belief is that children are "God-given" and that the creator is responsible for feeding them. God, therefore, has provided them with an abundance of resources in the form of land and forests which can be exploited if there are more people. Moreover, in Rwandan culture it is believed that each person has a right to own land, which may be one of the reasons why virtually all households in Rwanda do own land, however small that landholding may be.

Economic forces: Since the time of hunting and gathering, larger families have been economically better off than smaller families in most parts of sub-Saharan Africa, including Rwanda. In addition to more hunting and gathering, larger families were in a better position to protect themselves from natural disasters and ethnic conflicts. The introduction of agriculture re-emphasized the importance of large families, since more people could acquire even more land, making the larger extended family comparatively well

off. In many countries industrialization and urbanization have shifted the mechanism for upward mobility from manpower to machines. Consequently, this change has diminished the importance of big families and has lowered fertility rates in many countries. Since Rwanda has not gone through the process of industrialization and urbanization, and is still heavily dependent upon agriculture, children continue to be a socio-economic asset to their parents.

Children begin helping their parents at a very early age. They work on the farm, collect wood and water, and care for younger siblings. It is their duty to respect their elders, and to help their parents throughout their lives. They provide "free labor" to their parents when they are young and old age security when they get old (Clay and Vander Harr, 1989).

Medical reasons: There are two medical reasons that stand out in their effect on fertility. First, limited health care practices and facilities in the Third World means that mortality rates have remained high, particularly infant mortality. Countries with higher infant mortality tend to have higher fertility to replace those who die, a phenomenon known as the "replacement hypothesis". Rwanda still has a very high rate of infant mortality at 122 per thousand which encourages parents to have higher fertility and to ensure more surviving children.

The second reason is a resistance to modern medicine in Africa, as evidenced by the continuing employment of traditional healers throughout the continent. Rwanda is not an exception. It is believed that for this reason, contraceptives, being "modern medicine", have not been widely used (Caldwell, 1987). This resistance became more powerful when people heard about the side effects of contraceptives which are often genuine and confirmed by the medical profession. Moreover, many of the country's health centers and some of the hospitals are run by Roman Catholic Missions which do not offer family planning advice and contraceptives (Hamand, 1982).

Administrative obstacles to implementation: In the presence of strong pro-natal social forces in any society only a very strong family planning program could bring about some positive change. Unfortunately, with the exception of China, most developing countries have discovered that the obstacles to family planning are greater than initially anticipated and that administrative weaknesses in family planning programs have prevented them from achieving their targeted level of lower fertility. These weaknesses can be grouped as follows:

1. In almost all countries all development programs including family planning programs, are planned and implemented by government officials from urban

areas and are delivered top to bottom without any input by the clientele (Axinn, 1969; 1976; 1986; Crouch, 1981).

2. Inadequate impersonal and inter-personal communication channels are used to deliver the motivational messages and contraceptives (Axinn, 1985; Cernea, 1981, 1987; Lingameni, 1981; Mathews, 1982).
3. Programs are not supported by the appropriate economic incentives for adopters (World Bank, 1983).
4. The headquarters are provided with inaccurate reports of achievement based on false data by the field workers because their services depend upon their achievements (Chambers, 1983; Hauser, 1979).

In fact it appears to be an impossible mission to encounter the above mentioned problems in poor countries with very limited resources and loose governmental control. These problems seem to be inherent in almost all developing countries.

Family planning programs in Rwanda are experiencing the same "natural" problems. All decisions are made in Kigali by the government officials under the direction of international donor agencies. No effort has been made to get the input of clientele and the traditional ethnic leaders.

In general young men are hired to motivate the people who are concentrated in urban areas only. These workers are not a suitable inter-personal channel because: 1) the target group is scattered in remote rural areas and is not easily accessible, 2) most of the contraceptives are meant for women and in most developing countries, including Rwanda, men do not openly talk with women on matters dealing with sex, and 3) health centers are being used as centers for distribution of contraceptives, and such centers are very few in number throughout rural Rwanda (personal interviews with various Rwandans). Thus more than 90% of the population which reside in rural areas have very limited access to contraceptives and their distributors.

Finally, as mentioned above, higher fertility in Rwanda is associated with higher economic benefits. Reducing fertility means surrendering those benefits. The current family planning program does not provide any reasonable compensation for those who reduce their fertility in Rwanda which makes these programs un-attractive.

Summary

Rwanda is an agrarian society where direct "hands-on labor" are still used in all phases of farming. Children, therefore, represent an economic value to their parents. This economic value enhances an already existing desire for large families, interfering with the family planning program

and lowering the demand for contraceptives. Results of family planning programs from other developing countries suggest that various structural determinants of fertility which encourage higher fertility in those countries dominate the effects of family planning programs. These studies further suggest that developing nations must emphasize structural changes in their societies, and they must create a willingness to use contraceptives. According to some, in such a situation fertility will decline with or without official family planning programs (Davis, 1967).

I assume that one of the more important structural determinants of fertility in Rwanda is landholding. Its ownership, size, and quality have differential impact on attitudes toward fertility. This study will provide an insight to policy makers on the significance of this structural determinant. By examining the direct and indirect effect of landholding through other variables such as education of husband and wife, age of husband and wife and the wife's age at marriage, her participation in the labor force, and temporary migration of husbands, policy makers will be able to concentrate on bringing about structural change of the sort that reduces fertility. Among the more important of these might be policies regarding land inheritance and land distribution. In addition, this study will identify the opinions of husbands, wives, and children on landholding, and on the desired and recommended number of

children which can be incorporated into a new family planning policy for the country. Past and current research on fertility has identified various structural determinants of fertility. Some of these determinants are reviewed in the following chapters.

CHAPTER 4

THEORETICAL CONSIDERATIONS

History of Demographic Theories

Concern about population size and its relationship to land and other resources can be traced back in history to the time of Confucius in China, to Plato in Greece, and to 300 B.C. in India (Keyfitz, 1972). However, the origin of demography as a field of study took place in 1662 with the publication of John Graunt's Natural and Political Observations .... Made upon the Bills of Mortality. Further investigation into population questions took place around 1700 in England and France. Other nations in Europe including Holland, Sweden, Switzerland, Italy, and Denmark contributed to the classic work on demography in the middle of 18th century (Lorimer, 1959). Only in the 19th century, however, did the discipline get its technical name of demography. In the same century the controversy over the theological and philosophical issues of population growth was initiated by Geoffrey Goodman and George Hakewill in England. The writings of Vossius and Montesquieu were influenced by this controversy. Robert Wallace provoked David Hume to write his classic skeptical reply suggesting that the ancient world was superior and that optimum level of population would never be achieved. The writings of David Hume influenced

Thomas Malthus to write his classic essay on population (Glass, 1965).

Thomas Malthus on population

Malthus published the first edition of his essay on population in 1798 which was refined and changed on many occasions up to its latest version which appeared in 1830. Malthus (1830) begins his doctrine on population with two assumptions namely: 1) Food is necessary to the existence of man, and 2) The passions between sexes is necessary and will not change over time. He further suggests that the power of population is greater than the power of the earth to produce. From this he infers that population, when unchecked, increases geometrically (1,2,4,8,16,32) and subsistence arithmetically (1,2,3,4,5,6). He further suggests that an unchecked population could double in size in 25 years. The checks on population identified by Malthus were classified as either positive or negative. Positive checks include hunger, disease, and natural disasters which keep mortality high and population growth low. Negative (preventive) checks in his theory were late marriages and abstinence (Keyfitz; 1972; Peterson, 1961: Thompson, 1953).

Since the first publication of Malthusian theory on population two centuries ago, it has been widely criticized. One of the main criticisms of the theory is the ratios used by Malthus and his inability to foresee the

impact of industrialization on fertility (Thompson, 1953). Regardless of his critics this theory remains a landmark in the development of the discipline of demography and was the first systematic statement of the relationship between land availability and fertility. For this reason it has special relevance to the study at hand.

Demographic Transition Theory

Another classic theory relating to population growth, known as demographic transition theory, was introduced in this century. At the time this theory was developed, Europe had experienced its first declines in fertility as a result of industrialization and urbanization. Other parts of the world were still predominantly agrarian and rural. Comparing traditional and modern societies, Frank Notstein (1945), Davis (1945; 1949), and Thompson (1928, 1953) argued that traditional societies are characterized by high fertility and mortality. However once traditional societies experience social changes associated with because of industrialization and urbanization, attitudes regarding fertility and family size begin change. Once these societies are fully industrialized and urbanized they experience low fertility and mortality. However, the transition from traditional to modern demographic rates leads to an explosion in population because it is mortality that declines first. Various developed countries in Asia, Europe, and North

America are the examples of modern societies and have experienced sharp declines in fertility. On the other hand, many African and Asian countries, are in the transitional stage which is characterized by low mortality, high fertility, and rapid population growth.

Rwanda is still an agrarian and rural society where 94% of the population derive their livelihood from the land. On the other hand, it is experiencing some industrialization and urbanization, coupled with gradually improving medical facilities. This combination of traditional and modern characteristics stands as a classic example of transitional society where fertility remains high and mortality has started to decline, leading an explosive population growth.

Structural Determinants of Fertility

Fertility rates in many of the industrialized countries have experienced a long term decline, with minor fluctuations, and have now achieved below-replacement levels of fertility. At the same time as fertility was decreasing, dramatic socio-economic changes were taking place as a result of industrialization.

The remarkable decline in fertility in industrial countries over the past three decades has attracted the attention of demographers who have examined this phenomenon in great detail and reached some fundamental conclusions regarding the factors behind low fertility. Some of the

important variables believed responsible for lowered fertility observed in the industrial world include the following: industrialization, urbanization, increased income, higher levels of education, declining faith in religion, female participation in the industrial labor force, a desire for freedom and liberty on the part of women, and above all, the availability of contraception and its acceptance by society as a method of fertility control.

As discussed earlier, the controversial population problem, was first introduced by Malthus in the 19th century, who dealt primarily with overpopulation resulting from high fertility. Malthus did not visualize the possibility of remarkable declines in fertility and a declining population as a result of industrialization in the 20th century. This gap between theory and practice was filled by demographic transition theory.

Demographic transition theory, introduced in the mid-40s by Frank Notestein and Kingsley Davis, examined population growth with reference to economic development and argued that urbanization, industrialization, and modernization does have a negative impact on both fertility and mortality (Davis, 1945; McQuillan, 1984; Peterson, 1972).

Semyonor (1980) argues that low fertility in the developed world is the ultimate result of industrialization, which increases the income, education,

and participation of women in the industrial labor force and brings an overall socioeconomic change in society.

Hiday (1978), discussing the relationship between socioeconomic status and fertility in the Philippines, concluded that in Magasaysay and Matanao the women with higher socio-economic status had lower fertility. This lower fertility in these villages was attributed to late marriages and childlessness during the early years of marriage. Late marriages were mainly due to the involvement of women in educational activities, followed by the childlessness in the early years of marriage.

In a similar study in Malaysia, another country which has experienced a dramatic economic and demographic change over the past decade, Davanzo and Haaga (1982) concluded that fertility has fallen in this country because of socio-economic development.

Similar conclusions are drawn by Freshnock and Cutright (1978) in the US. Based on 1970 U.S. census data they suggested that socioeconomic determinants of childlessness are very strong for both white and black women. Socio-economic background was determined by population density, place of residence, education, migration, and labor force participation of women. The research suggested that if alternative roles are available for women in a society, they will engage themselves in more rewarding activities than child bearing, and the successive

postponing of children will eventually result in voluntary childlessness.

This thesis has been further explored by Happel et al. (1984) who suggest that the timing of childbirth is also determined by the socioeconomic conditions of women. They found that the involvement of women in extended post-secondary education programs and later on in higher paying jobs are incentives for the postponement of childbirth in the U.S. Similar conclusions have been drawn for Canada by Kyriazis and Henripin (1982) who suggest that rapid socio-economic changes in Quebec, Canada have contributed to a decline of marital fertility in that province.

Modernization has been considered as another important determinant of fertility by demographers. In a study based on U.N. data for 36 countries and which used economic development, health conditions, and women's status as indicators of modernization, Poston and Katherine (1984) suggest that modernization leads to lower fertility. However, they found that modernization in the early stages may also contribute to an increase in fertility by providing better food and better health facilities in their childbearing years, and to a decline in the infant mortality rate. For example, the fertility of native American Indians was low before modernization (Diamond 1932) but it increased gradually due to modernization as better health facilities, settled life, and better food were provided (Romaniuk 1981).

Later periods show reduced fertility with further modernization.

The relationship between women's employment and fertility behavior have also been researched at some length by demographers. Jones (1981), in a study in a study of U.S. women concluded that the impact of women's employment on fertility was negative. Happel et al. (1984) reached similar conclusions in their study of U.S. married women and argued that economic incentives associated with higher-paying jobs motivate women to postpone childbirth. Findings from another study carried out in Scotland indicated that career women try to postpone their first births and further indicated that childlessness in Scotland is the result of a desire for greater autonomy by women. Cutright and Polonko (1977) suggested that when there are opportunities to engage in alternative roles which are more rewarding than child-rearing, then successive postponements of childbirth will result in voluntary childlessness. Labor force participation has become so important to women in the developed world that a large number of young women retain close ties to the labor market during the months just before and after childbearing. Childbearing and child-rearing are considered by these young women, to be interruptions to their careers and therefore most of them return to their work when their youngest children reach school age or even before

(Mincer and Polacheck 1974). Children in this situation are an economic liability.

Education is another important variable which provides greater opportunities for women to participate in the non-agricultural labor force and which has been shown to be an effective factor in changing the demographic processes of fertility. From a panel study of the U.S., Pol (1983) concluded that higher education was related to childlessness. Jain (1981), in another study of women in Costa Rica, concluded that advancement in female education increases the potential of females to participate in the modern economic sector, which in turn leads to a downward trend in fertility. She further stated that average fertility was found to be similar among women in Costa Rica, Columbia, Dominican Republic, Panama, Fiji, Korea, Malaysia, Pakistan, Sri Lanka, Thailand, and Indonesia, where the rates of female education were approximately the same. She further observed that an increase in the number of years of schooling was negatively correlated with fertility in all of these countries. Sathar (1984), in her study based on World Fertility Survey data, observed the same results for Pakistan. However, the difference in fertility among women without schooling and those with up to five years of schooling was found to be insignificant in Pakistan. Casterline (1985) also reached a similar conclusion from a study conducted in Egypt, where it was found that both

parental and child education had a negative effect on fertility. Courbage (1984) in his research in Haiti based on World Fertility Survey data, suggested that the government can only be successful in reducing fertility if it can promote education for women, provide for female participation in the non-agricultural labor force, and develop better health care for children. In a very recent study in India using the data from 326 districts and covering 90 percent population of the country, researchers found a significant negative relationship between female literacy and fertility levels. The study suggests that this negative relationship is a result of 1) general knowledge, 2) speedy diffusion of information, 3) non-traditional roles, 4) later marriages, 5) and use of contraceptives among literate women (Population Institute, 1990).

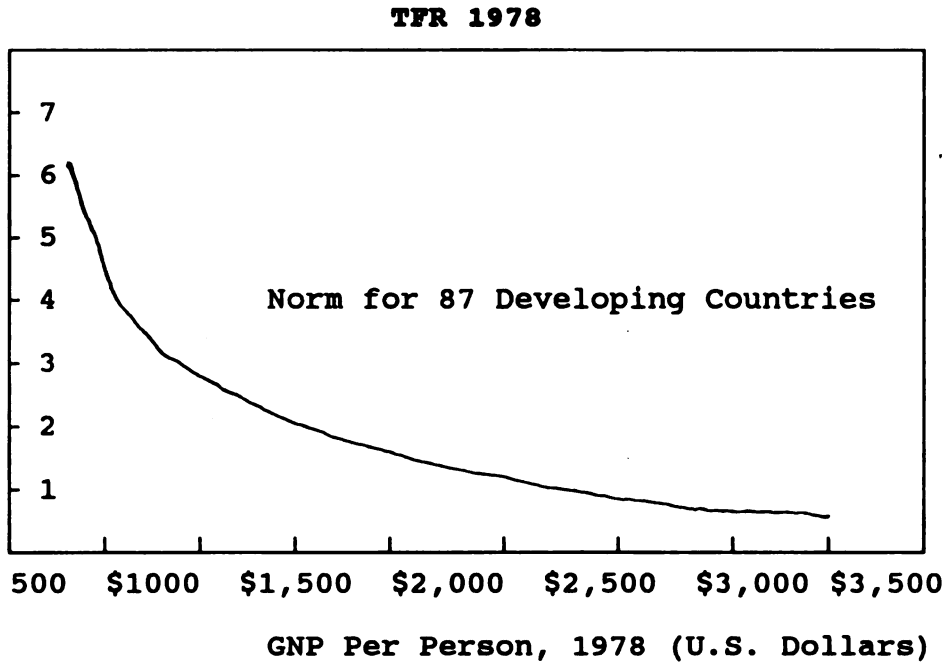
Another important variable affecting fertility is income. Most demographic researchers have reported that a husband's income is inversely related to the number of children born to his wife. The same trend is found at the macro level when GNP was compared with the fertility rates of 78 nations (Figure 2). However, this result has puzzled economists who argue that higher levels of income should increase the family's ability to support dependents (Becker, 1960).

In the 1970 National Fertility Survey in America, income was found to be inversely related to both wanted and

unwanted numbers of children ever born to women aged 35-44 years (Westoff and Ryder, 1985). Johnson and Sue-Wen (1985) draw the same conclusion and suggest that despite the greater ability of rich couples to support numerous children in U.S.A., the actual income of husbands failed to show any positive association with

FIGURE 2

FERTILITY IN RELATION TO INCOME: DEVELOPING COUNTRIES, 1978.



Source: China: Country Report World Bank, 1983.

the wife's cumulative fertility. McQuillan (1984) found that per capita income was negatively correlated with both age at marriage and marital fertility in France. However, Poston (1974) stated that childlessness in the literal sense tended to be at its highest at both the upper and lower ends of the income continuum. He also found that the relationship between income and childlessness is not always inverse. The Canadian studies on income and fertility also underscore the negative effect of income on fertility. Grindstaff et al. (1981) concluded that Canadian women who have higher family incomes, higher levels of education, and who are involved in the labor force generally have higher rates of childlessness. Wolowyna (1977) indicated that income in Canada is directly related to voluntary childlessness. Tomes (1985) also indicated that income in Canada has a negative effect on fertility. This phenomenon was examined from a different angle in Nigeria by Caldwell (1976) who concluded that, in Yoruba families in Nigeria, there are primitive, traditional, and transitional societies. High fertility in primitive and traditional families exists because children cost very little and start earning very early. He states that transitional families in Nigeria, which consist mainly of educated middle-class families, practice high fertility because there is a strong emotional bond between the children and parents, and as the children become older and enter the labor force, it is expected that they send money to their

aging parents in the rural area. This flow of wealth was viewed as the cause of high fertility in this tribe of Nigeria, but Cain (1982) refuted this idea arguing that income may affect fertility in some societies but not in others. In the case of societies such as Nigeria and Bangladesh, fertility is high because of the future productivity of children, while in others where fertility rates are equally as high, e.g. Kuwait, the flow of income is from parents to children.

The relationship between the economic utility of children and fertility has been explored by demographers as one of the key determinants of fertility in agrarian societies. Considerable literature both for and against, is available on the issue; much of this research is discussed in some detail in the following chapters. Rosenzweig (1977), in a study of U.S. women found that there is a relationship between the economic utility of children and high fertility, but he further observed that birth rates were falling in farm populations because wage rates for farm labor were low when compared to non-farm wages, and because of a reduction in the value of children due to improved technology. This phenomenon was challenged by Vlassoff (1982) in his study in India. Vlassoff concluded that the economic utility of children, their labor contribution, and old age security associated with children have no significant effect on attitude to and actual fertility in rural India.

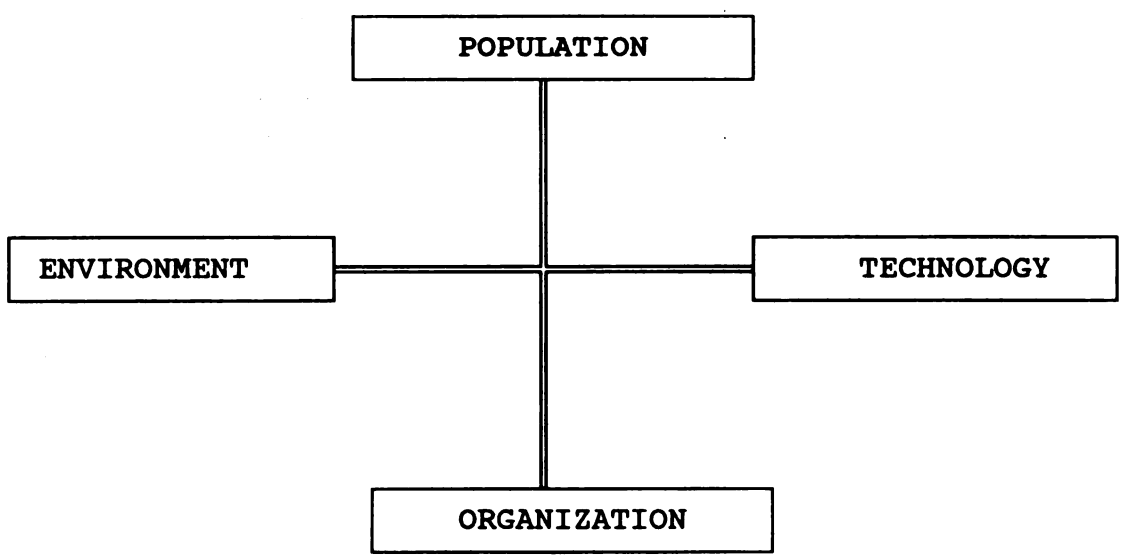
Theoretical Roots of the Current Study

The current literature on population structure and dynamics, and on their determinants and consequences is very large. In the following pages I will concentrate especially on literature directly related to the main hypotheses of this study.

Various social scientists (Bilsborrow, 1987; Duncan, 1972; Eversley, 1972; Frank, 1972; Namboodiri, 1988; among others.) have argued that a strong relationship exists between the size of any population and its environment. In this context, the POET model (Figure 3) presented by O.D.

FIGURE 3

THE ECOLOGICAL COMPLEX



Source: O.D. Duncan (1972).

Duncan (1972) stands as a classic. Otherwise known as the "ecological complex", this model suggests that each society is an interdependent system consisting of four interrelated dimensions: population, organization, environment, and technology. Population in this model refers to the population of living organisms that cannot survive in isolation. The individuals in these populations must adapt to the environment as well as to other organisms, using available technologies. Difference in populations and environments tend to differentiate one society from another. Since each society relies on different technologies to exploit its environment and are exposed to different natural changes, societies are further distinguished from one another. Finally, the organizational dimension of this ecological complex ties together and influences all three of the other components which are linked through what Duncan (1972) has labelled "functional interdependence".

Since population change, notably population growth as a result of higher fertility, is the focal point and dependent variable in this study, the ecological complex has been adapted to emphasize this approach as shown in Figure 4. This conceptual reformulation suggests that population structure (size, composition, and distribution) and its dynamics (change in fertility, migration, and social mobility) are shaped by environments, technologies, and organizations. It further indicates that population

FIGURE 4

ECOLOGICAL COMPLEX EMPHASIZING POPULATION CHANGE AS DEPENDENT VARIABLE

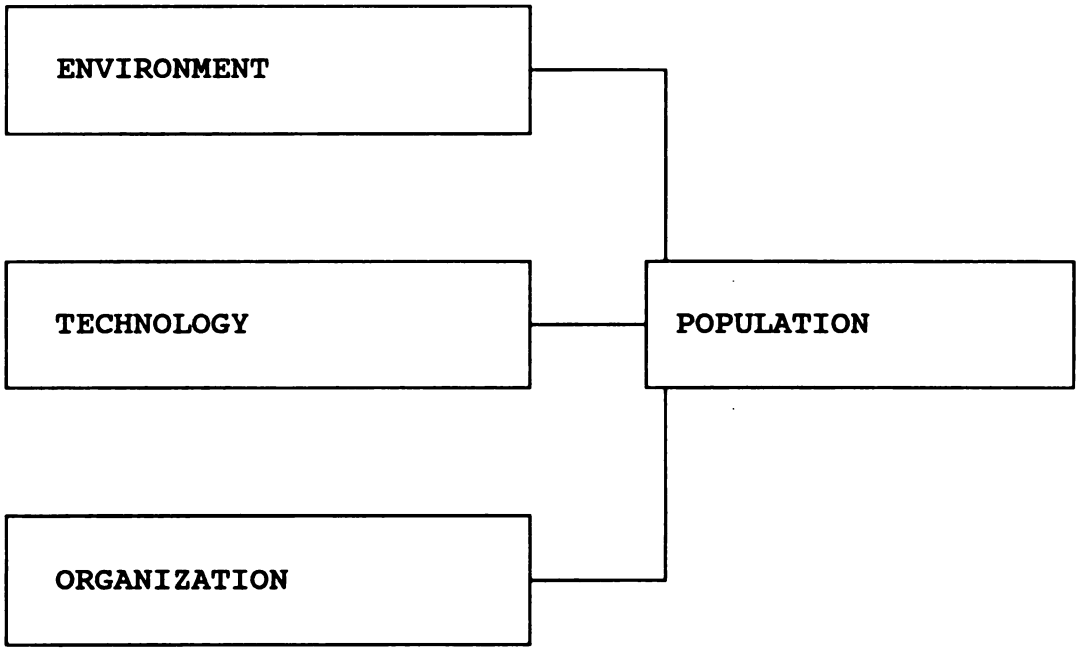
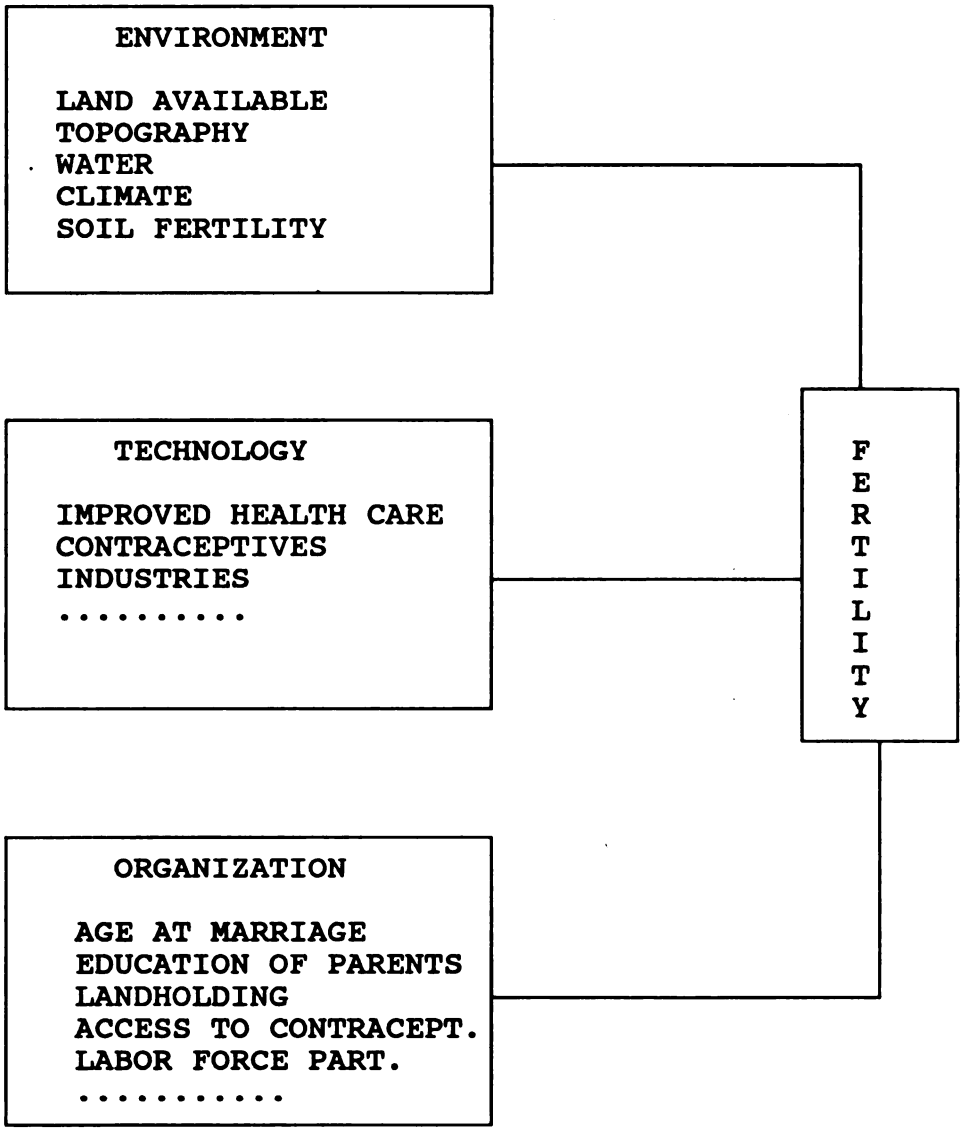


FIGURE 5

ECOLOGICAL COMPLEX EMPHASIZING FERTILITY AS DEPENDENT VARIABLE



variables have a reciprocal or interactive relationship with environments, technologies, and organization. An elaboration of this leads to the scheme shown in figure 5, which reflects the following adjustment: 1) fertility behavior is retained as the one population variable of interest, and 2) it identifies some of the principal environmental, technological, and organizational variables that contribute to variations in fertility behavior, particularly in the Rwandan context.

Early settlements of human populations were always influenced by the physical and natural environments including land and its fertility, forests, mountains, rivers, oceans, and weather conditions (Hockett, 1973). Evidence based on various estimates suggest that population growth in prehistoric societies in the food gathering stage was directly related to the natural environment. Environments with abundance of food nurtured more rapid growth of population. On the other hand, the less advantaged environments led to hunger and higher mortality rates, resulting in relatively slow population growth (Dumond, 1975). With the introduction of early tools for hunting and shelter the man-made aspect of the environment came into existence. Further change took place when settled agriculture was begun by human populations, and the web of social relations grew even tighter. With this the concept of ownership of land came to existence. Since the most

important resource of the natural environment has been land, at least for most human populations, land ownership grew in importance for most families. The relationship between individuals and their environments had many consequences. One of these consequences was the family's need for more and more help to work on the family land. In turn this lead to higher fertility.

Dramatic changes in the relationship between man and his environment took place in connection with the industrial revolution. The dependency of man on natural environments and manpower was shifted to man made goods and machines. This shift in technology influenced the relationship of all components of the POET model. The impact of this change on fertility behavior is explained by demographic transition theory, as described earlier.

The evolution of society was accompanied by a broad and diverse set of interrelated social institutions. The main function of these social institutions was to control and streamline the complex relationship of individuals with other individuals and with their environments. Over time these man- made social organizations became external to the individual and anchored him to the social norms of various economic, political, educational, socio-cultural, and religious organizations. These organizational relationships have both direct and indirect effects on fertility.

As depicted in the model, environments, technology, and organizations have a direct effect on fertility. Available land and its productivity, topography, climate, and water are among the many environmental factors that may influence fertility. Industries, health care, contraceptives, and many other technologies may also affect human fertility. And finally, age at marriage, education of parents, access to land, access to contraceptives, and labor force participation are some of the principal organizational factors that are known to influence fertility.

Theoretically, the four major components of the ecological model: population, environment, technology, and organization, constitute an equilibrium-seeking system. A significant increase or decrease in one component disturbs the remaining three components and requires necessary change in them to keep the balance. For example, a rapid increase in population would require change in technology, environments, and organization to cope with the increased pressure caused by population growth. Another alternative to keep the balance, however, would be to control population growth itself.

Man-Land Ratio.

This study explores the link between the environment and population as suggested in the above models. As mentioned earlier, however, landholding constitutes the

most important aspect of our natural environment, and as a natural resource its availability is finite. Over time the man-land ratio changes primarily because of population growth. This change varies from time to time and from region to region. However, the long term trend has been on upward trajectory (Hockett, 1973).

There are different estimates about the first appearance of homo-sapiens on earth. Some suggest it occurred 1 million years B.C., while others argue that man appeared on the scene some 400,000 years ago (World Bank, 1984). Regardless of the date, the evidence suggests that the total population on earth never exceeded ten million before the agricultural age in about 8,000 BC. During this time, the rate of increase remained between .001 to .002 percent per year on average. The population density was as low as .01 to 2 per square mile. It is estimated that at times there was one person for 200 square miles of land (Davis, 1949). This low rate of population growth was largely a function of biological mechanisms (including species-specific patterns of intra-space and inter-group social competition), cultural constraints, and natural checks (Polgar, 1986). Following the Agricultural Revolution, the earth's population climbed to ninety million in the next four thousand years (Hassan, 1986). But the first real burst of population growth came with the Industrial Revolution (Davis,

1949) beginning in the mid-1700s. Table 3 shows the dramatic changes in population growth over time.

Let us now turn to look at how the man-land relationship affects fertility in a rural setting where land is still the key natural resource in the environment, primarily because it provides livelihood to its population.

Landholding and Fertility.

An extensive review of the literature on how the man-land relationship can influence fertility in rural areas has been presented by Stokes and Schutjer (1984). In this review they begin by asserting that land tenure is fundamental to the economic and social organization of rural societies and that land is a symbol of status, power, and wealth. They further suggest that access to land could be of two types: 1) the amount of land to which a household has access for cultivation purposes, and 2) land ownership. Both of these dimensions generate income through labor, management, and equity. An individual, family, or household with use rights of land (renters, sharecroppers, lessees, etc.) receives a return only to management and labor. Those with no rights have a return only to labor. The owner-operator receives all three types of return, including equity. They conclude that income from equity and income from labor and management have distinctly different

Table 3. World Population and Rate of Growth, 300,000 BC to 1990.

Year	Estimated Population	Estimated Growth Rate
8000 BC	1 million	.005
3000 BC	10 million	.05
2000 BC	20 million	.07
1000 BC	20 million	.00
0 BC	30 million	.04
1100 AD	30 million	.00
1350 AD	35 million	.06
1450 AD	35 million	.00
1650 AD	60 million	.27
1750 AD	77 million	.25
1850 AD*	1,171 million	.51
1900 AD*	1,608 million	.63
1940 AD*	2,171 million	.75
1990 AD**	5,321 million	1.80

Sources: World Bank (1984)
* Kingsley Davis (1948)
** Population Reference Bureau (1990)

implications for fertility behavior. They suggest that land ownership and size of operational holdings have opposite effects on human fertility. The size of holding to which a household or family has access for cultivation purposes encourages higher fertility because of the economic utility of children based on the labor they provide. Land ownership, on the other hand, has a negative effect on fertility because it generates income by itself and alters the dependence of

parents on children for old age security. These two opposing influences have been referred to as the "land-labor demand hypothesis" and the "land security- hypothesis". The following sections discuss both of these important hypotheses in detail.

Land-Labor Demand Hypothesis

The concept of demand for children refers to a "decision maker's view on alternate family-building outcomes, abstracting from attitudes towards the family building process, including such areas as intercourse, contraception, and breastfeeding" (Lee and Bulatao, 1983).

The land labor-demand hypothesis suggests that an increase in landholding results in greater work opportunities for children, which in turn creates a higher demand for children, and thus higher fertility. This argument is based on an economic model of fertility introduced by Becker (1960, 1965) and was further elaborated upon by various other social scientists including Becker and Lewis (1973); Ben-Porath (1973); Easterline (1966, 1969); Enke (1973); Gardner (1973); Kuznets (1970); Schultz (1973); and Willis, (1973). The economic model of fertility is based on two fundamental assumptions: 1) that couples behave in a rational way when they decide on the number of children they want to have, and 2) that children are viewed by couples more or less as consumption goods (Andorka, 1978). Where children are viewed

as consumption goods, the supply of children is determined by their demand. If they are cheap and more useful, the demand will be high. If they are expensive and less useful, the demand will be low. Most of the studies mentioned above report that in any society, commodities are produced in quantities determined by maximizing a utility function of that commodity. Utility is determined by individuals by maximizing satisfaction, given a range of goods, their prices, and their own tastes and incomes. Children in this situation are viewed as a special kind of good, and fertility is seen as a response to the consumer's demand for children relative to other goods. Demand for children, therefore, is determined by the parents in response to the economic considerations in the children they bear and rear and by the equation they make between their sacrifices and satisfactions. If the equation suggests that the quantity of children is economically beneficial to the parents, they will bear a higher number. On the other hand, if the quantity of children becomes more expensive than their output, then parents begin to limit the number of children they have. Relatively recent arguments on the economic costs and benefits of children associated with fertility can be found in Birdsall (1988); Caldwell (1983); Clay and Johnson (1990); Easterlin and Crimmins (1985); Fawcett (1983); Kamuzora (1984); Lindert (1983); Mannan (1989); and Victor (1984).

This general economic model of fertility behavior is applied to the land labor demand hypothesis which suggests that fertility in rural areas is influenced by the economic utility of children. This attitude toward fertility in rural economies is determined by the demand for children in the labor force. This demand is signified by the fact that children in rural society have an economic utility which begins at a very early age (Caldwell, 1983). Young children in rural areas collect wood for fuel, fetch water, care for their younger siblings, keep watch over grazing animals, and do other minor agricultural work (Mannan, 1989). In some cultures they even help their parents in heavy agricultural work including planting, weeding, and harvesting. Elsewhere they work as house servants, agricultural laborers, and helpers in technical jobs, whatever brings in hard cash for the household. As soon as they reach adulthood they become an economic asset[1] for the household. They start supporting their parents and the household by renting in land if it is available or try to find non-agricultural employment. This economic utility of children in rural areas increases the demand for children. These arguments suggest that the higher demand for labor in rural societies is a major determinant of the higher demand for children. Since rural economies

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[1]. The economic utility of children is a relative term. A child in a developing country who brings in $15 a month may be an economic asset for a household but may be a burden in a rich country.

heavily depend upon agriculture, it can be anticipated that agricultural activity will have a direct influence on the demand for children. It can be further surmised that households in rural economies that depend upon agriculture should have a higher demand for children. This argument can be further extended to suggest that in rural societies, households with more land will have a greater demand for children. In short, this is known as the land-labor demand hypothesis (Lee and Bulatao, 1983; Mueller and Short, 1983; Schutjer and Stokes, 1980, 1983; Stokes and Schutjer, 1983;).

The economic rationality of children, as discussed above, has its roots in the notion of social rationality. In its most elementary formulation, the concept of rationality means that households choose the kinds of actions that maximize their own self-interests (Swedberg et al. 1990). Max Weber, in his theory of rationality, suggests that individuals have become increasingly rational over the course of time . Societies, too, become increasingly rational. They tend to set subjective goals and then adopt means that are effective in attaining these ends (Turner and Beeghley, 1981). It can be inferred from Weber's discussion on social rationality that the number of children parents will have in any society is a socially rational decision. In an industrial urban society, parents emphasize the quality of children, not the number. Thus, by having fewer children they are able to maintain their quality -- a socially

rational decision in such societies. By contrast, having more children is a socially rational decision for parents in developing agrarian societies for the following reasons: 1) most traditional societies practice traditional religions which encourage high fertility, 2) parents want to have children, particularly sons, for purposes of maintaining the family lineage, 3) chances of survival in the event of natural disaster or ethnic conflict are improved for larger families, 4) close relatives in the family help mothers in raising their children, making it a social rather than an individual responsibility, 5) children often provide life long love, affection, and financial support to their parents.

This discussion of economic and social rationality leads to the conclusion that there is a fundamental interweaving of economic and social rationalities for childbearing in developing societies, and that one clearly reinforces the other, and vice versa. This compounded rationality is obvious in both Land-labor demand and Land-security hypotheses explored in the following pages.

Empirical research the world over supports the notion that landholding has a positive effect on fertility. Studies in the United States, Canada, and Western Europe (Yasuba, 1962; Connell, 1965; Demeny, 1968; Forster and Tucker, 1972; Easterline, 1976; Shapiro, 1982) suggest that as long as the economy of these countries is predominantly agricultural, the fertility will be high. With a decline in

the availability of farmland the demand for children likewise diminishes. A decline in the demand for children leads to a decline in fertility. This lower fertility in urban, industrial countries has been achieved primarily through the postponement of marriage and use of contraceptives.

Evidence from developing countries, too, correlates this positive relationship between landholding and fertility. Evidence from Asia comes from Bangladesh, Thailand, the Philippines, India, Nepal, and Iran. Africa is represented by Egypt, and Latin America by Guatemala. Stoeckel and Chowdhury (1980), e.g., using a sample of over 100,000 mothers, suggest that land is positively related to fertility in Bangladesh. Arnold and Pejaranoda (1977); Chalamwong et al. (1979) and Prasithrathsin (1971) report a similar positive relationship of landholding with fertility in Thailand. In the Philippines, a rural survey was conducted in 1952 to study land tenure and land use. Using a sub-sample of 2,380 married women taken from a total sample of 14,230 respondents, Hawley (1955) found that fertility was positively related to farm size. Driver (1963) used a detailed interviewing schedule to explore the determinants of fertility in Nagpur, Central India. From his sample of 363 households, he found that mean fertility in India has a positive association with landholding. In neighboring Nepal, Tuladhar et al. (1982) confirmed that larger families are valued in rural areas, which systematically connects higher

fertility to families with higher landholding. Ajami (1976) reports similar conclusions from Iran based on his findings that landholding has a positive association with desired number of children, children ever born, and living children. Based on their survey of 1,200 hundred ever-married women in rural Egypt, Schutjer, Stokes, and Poindexter (1983) suggest that size of cultivated landholding is the strongest predictor of children ever born. An anthropological study from Guatemala (Odell, 1982) reports that farmers with irrigated land have much higher fertility than the basketmaking families. He suggests that this phenomenon is related to higher demand for labor among farmers with land.

The Land-labor demand hypothesis has been criticized by various social scientists. Easterline, one of the pioneers in the economic modeling of fertility modified his position in saying that it seems that in many situations fertility cannot be explained by economic theory alone and that a demand-oriented model has very limited relevance in societies where there is no intentional check on fertility, which is an essential part of economic theory (Easterline, 1975).

Bulatao and Lee (1983) argue that it is not necessary that demand itself may lead to a changed behavior towards fertility. They suggest that sometimes the demand may exceed the supply and that sometimes people want to have

as many children as they can regardless of their need for labor.

Caldwell (1983) points out that the demand model based on an economic explanation of higher fertility may apply in the developed world, not the developing world. He agrees with the significance of the economic utility of children in rural areas of developing countries but argues that social factors dominate the economic factors related to higher fertility. He reaffirms his position by supporting his "wealth flow theory" one of the most powerful theoretical approaches to fertility behavior to emerge in recent decades (Caldwell, 1976, 77, 78, 80, 82, 83, 86).

Caldwell (1976) has criticized strictly economic theories of fertility in arguing that family size in any society is determined by personal, social, and physiological reasons, not just economic ones. He also claims that the movement of any society from high to low fertility or vice versa is essentially the product of social, rather than economic change, although with economic implications. Through his extensive work on the wealth flow theory, he concludes that fertility is high in societies where the inter-generational wealth flow (both material and non-material) is from children to parents. He argues that a reversal of this flow eliminates the demand for more children. His emphasis on social rather than economic

determinants of fertility serves as the point of departure for the land labor hypothesis.

Recently Mead Cain (1985, 1986) has criticized advocates of the land-labor demand hypothesis by arguing that the consistently positive relationship between landholding and fertility is not necessarily a consequence of purposive reproductive behavior. It may rather be an unintended by-product of other behavioral patterns that are associated with landholding status. This challenge is based on his assumption that all researchers dealing with this relationship have regressed children ever born on farm size and ignored the institutional arrangements governing land tenure and labor, and the possibility of obtaining employment outside of agriculture. Cain believes that such study should explore the influence of institutional arrangements such as land tenure patterns (land owned, land rented in and rented out, and land under operation) which he suggests might alter the impact of landholding on fertility behavior (Cain; 1977, 1983a, 1983b, 1984, 1985a, 1985b, 1986).

Empirical evidence contradicting the land labor demand hypothesis comes from Bolivia (Godoy, 1984). Census data were used to sketch the broader demographic profile and detailed questions on fertility were asked of all available married women in four villages in the highlands of Bolivia. The study reveals that within the highland population of

Bolivia, no statistically significant relationship exists between the age specific fertility of landless and landed women. Other contradictory evidence comes from Mamdani (1972), Mazur (1975), and McGinnis (1977) who argue that children are the means of acquiring, retaining, and improving land. This reverse hypothesis, however, has been negated by Clay and Johnson (1990) in their study entitled with "Size of Farm or Size of Family: Which Comes First?" in Rwanda.

Mead Cain (1985) contradicts the Land-Labor Demand hypothesis and asserts that it is not necessary that the positive relationship between landholding and fertility be the result of a deliberate effort on the part of rural populations, motivated by demand considerations. Rather, it is a by-product of other behavioral patterns that are associated with landholding status. One of these behavioral patterns observed by Cain in Bangladesh is husband's temporary migration for work. He asserts that temporary migration separates the spouses and leads to a lower frequency of intercourse and thus lower fertility. He found significant differences in the temporary among temporary migration patterns of the landless and those who own land in Bangladesh. He concludes that this difference accounts for the positive relationship between landholding and fertility in that country.

One other criticism of research finding on the positive relationship between landholding and fertility

arises from the survivorship hypothesis which suggests that landholding has a positive effect on standards of living. Higher landholding improves the nutritional level and medical care of both spouse and children, which in turn increases the child survival rates, i.e., higher numbers of living children.

Land-Security Hypothesis.

According to Stokes and Schutjer (1984, 1986) land ownership exerts a negative long-term effect on fertility. This effect takes place by altering the dependence of parents on children for old age security, and even by providing additional protection against risk during the productive years. They further argue that both factors may also influence natural fertility and the supply of surviving children by increasing income. Studies from Thailand (Prasithrathsin, 1971; Chalamwong et al., 1979), the Philippines (Hiday, 1978; Schutjer et al. 1980), Iran (Good et al. 1980); and India (Vlassoff and Vlassoff, 1980) support the land security hypothesis. Schutjer et al. (1980), for example, using child-women ratio (the number of children under age 5 per 1,000 women aged 15-49) as a dependent variable in a sample of 1,796 households in the Philippines, concluded that "the direct effect of landownership on fertility was positive. However, the indirect effect, which was relatively greater, was to reduce fertility" (page 95).

Good et al. (1980) found a negative effect of landownership on ideal family size and children ever born in India.

Criticizing proponents of the land-security hypothesis, Mead Cain (1985, 1986) argues that land is not a good substitute for children for the following reasons: 1) land needs hard work and management in order to be productive, 2) children provide emotional, psychic, social and economic benefits to their parents, and 3) land is often an insecure investment. From this he infers that although land is a substitute for both old age and risk insurance, it is not a good substitute when compared to children. He further suggests that those who are landless or have less land tend to have more children to secure their future. In some countries this security is achieved only by having a male child, which tends to increase fertility regardless of whether the household has land or not (Cain 1977, 1983a, 1983b, 1984, 1985a, 1985b, 1986. The general conclusion which can be drawn from Cain's criticism of the land-security hypothesis is that it is not land ownership itself which suppresses fertility in rural areas of developing countries. Rather, there are other rural institutional effects on fertility behavior regardless of whether one owns land or not. One of these other institutional factors is old age security provided to parents by children in developing countries.

Robinson (1986) disagrees with Cain by pointing out that poor people in developing countries cannot make long-time security planning, as claimed by Cain's old age security hypothesis. He suggests that there is no evidence that high risk and high fertility are associated. In his opinion the low cost of raising children and expected quick and high return from them is the main motivation for high fertility in developing countries. This higher fertility is found particularly among rural households because of children's utility in agricultural production and in asset-building for the household.

The debate on access to land and fertility continues. However, both sides agree that landholding has important positive and negative effects on fertility. Similarly, both sides agree that the specific mechanisms through which land ownership or size of holdings influence fertility are particularly important and that this is a "relatively neglected area of research" which needs more attention from social scientists (Cain, 1985; Stokes and Schutjer, 1984; Stokes et al., 1986).

Conceptual Framework and Working Hypotheses of this Study

The Debate of Schutjer and Stokes and Mead Cain On Two Hypotheses

Schutjer and Stokes (1982) contend that landholding has a two dimensional effect on fertility. On one hand, the ownership of land reduces fertility by providing old age security, and on the other hand it increases fertility as a result of a high demand for labor. The aggregate number of children, couples have, therefore, is a result of these contradictory forces. To partial out these effects, they operationlized landholding as "land owned and land operated as a proportion of total operational holdings". Mead Cain criticizes this operationalization and suggests that such a proportion does not account for the difference between the total landholding of various farmers. Moreover, a person who rents out all of his land would be considered as landless according to this definition (Cain, 1985). He, therefore, suggests that the absolute amount of land operated is crucial and cannot be ignored.

In my opinion, the best way to sort out these two effects is to examine the effect of landholdings for the two groups (owners and owner-renters) independently. More specifically, this study addresses the questions raised in the above review, as follows:

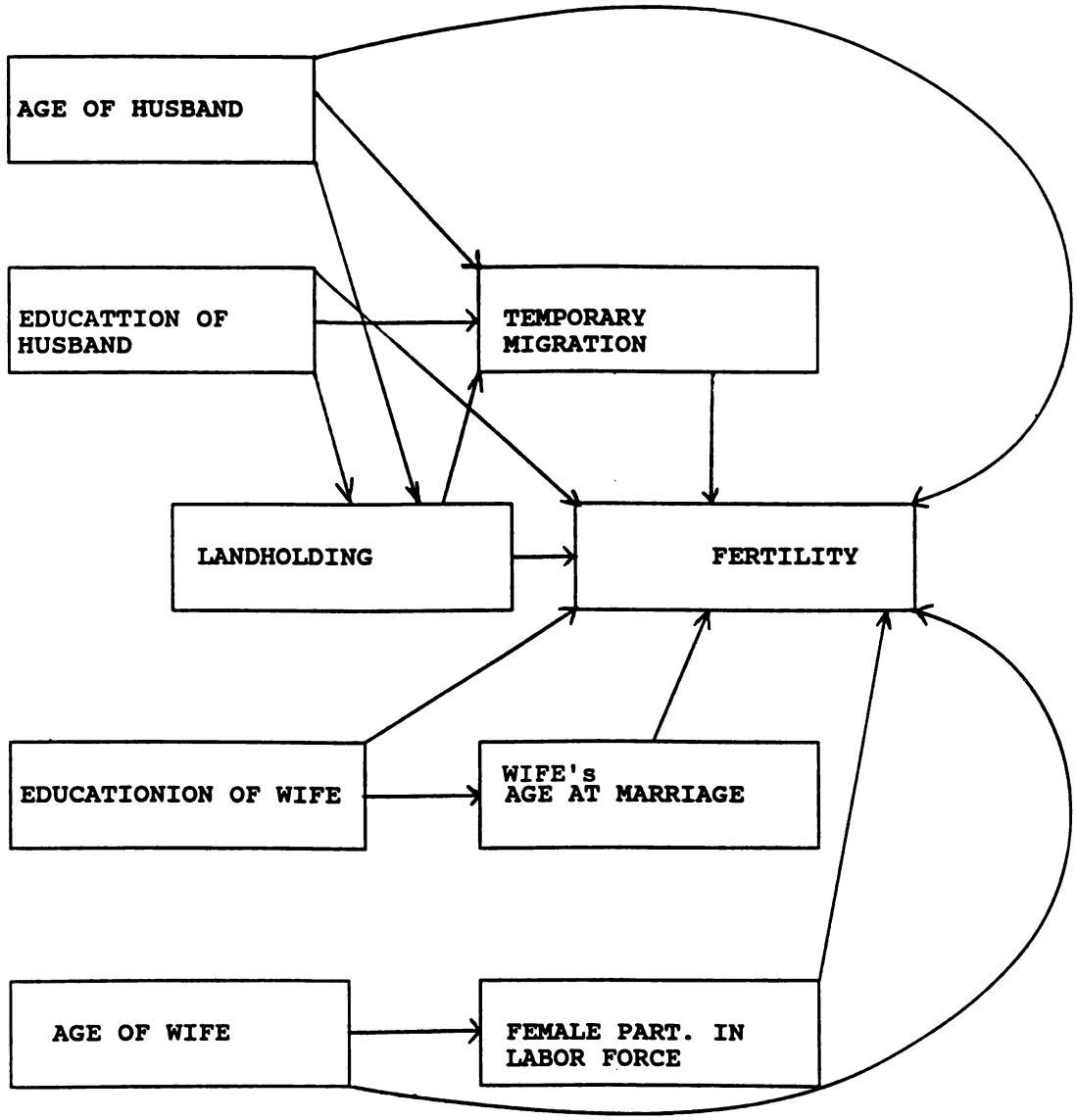
1. What is the relationship between the size of landholding (both owned and operated) and number of children?
2. What are the mechanisms through which, and conditions under which, landholding and/or ownership influence number of children?
3. What is the significance, if any, of the above mentioned debate in the African context, particularly in Rwanda where population density is high and access to land is limited ?
4. Do the attitudes and preferences of adult children and their parents about land and fertility shed light on the debate ?

To facilitate an empirical examination of these questions, many of the determinants of fertility behavior have been brought together in the conceptual framework shown in Figure 6. Central to this model is the relationship between landholding and fertility. It is anticipated that the land-labor demand hypothesis is most appropriate to the situation in Rwanda given the fact that the agricultural system there is highly labor intensive. Thus, I expect to find a strong positive association between operational size of landholdings and fertility, even while controlling on other variables in the model.

In order to test the land-security hypothesis, the

FIGURE 6

Landholding and Fertility
(Conceptual Model)



effect of operational holdings on fertility will be examined for two groups of farm households: those who own all of their holdings and those who both own and rent in land. It is postulated that due to the security value of land ownership, the relationship between operational holdings on fertility will be lower for owners than for those who rent some or all of their land.

Because temporary migration affects over half of Rwanda's heads of households (Clay and Ngenzi, 1989) it is expected that the length of time husbands spend away from the household in temporarily employment will lower the number of children born to them. Thus, to the extent that temporary migration occurs primarily among those with small operational holdings, as found by Cain (1985), it is hypothesized that temporary migration is an "intervening variable" accounting for at least some portion of the relationship between landholding and fertility.

As the age and education of husbands and wives are often found to be closely linked to fertility behavior and/or landholding as reviewed earlier in this chapter, these variables, along with the wife's age at marriage and labor force participation, are introduced as control variables. Special attention is given to the effects of age of the head of household--notably the possibility that part or all of the land-fertility relationship may be spurious due to the

concomitant variation of these two variables with the head's age.

CHAPTER 5

METHODOLOGY

General Introduction

Over the past decade the government of Rwanda, with the help of USAID has sponsored several projects with the goal of achieving greater institutional capacity in the areas of agricultural surveys, analysis and planning. An office within the Ministry of Agriculture and Forests has been created and assigned these responsibilities. Now known as the Division des Statitistiques Agricoles (DSA)[2] , this office has grown in size and now employs a central office staff of nearly 40 persons and a field staff of over 90 interviewers and supervisors. In addition to a large scale national agricultural survey, conducted in 1984, a large number of "special studies" have been conducted by DSA on topics given high priority by the Ministry.

Data examined in this study derive from one such study, the Non-farm Strategy Survey conducted in July, August, and September of 1988. The target population was the rural population (95.5%) of Rwanda. The unit of analysis was the household, defined as a group of people living

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[2]. Formerly the Service des Enguetes et Statistques Agricoles (SESA).

together in one house under the authority of a head of household who controls the resources and expenses. A multi-stage stratified random sample of 1,078 households was drawn in 1986. This initial sample was reduced by 5.4% drop-outs, leaving 1,019 households for which data were collected. Under the guidance of local and international professionals a team of 10 supervisors (acting as interviewers) interviewed husbands, wives, and adult children living in the household. Overall, interviews required approximately one and a half hours to administer and usually required multiple visits to meet with various respondents from each household. Special care was taken by interviewers to ensure that all appropriate household members were located and interviewed. Adult children still living in the household were the most difficult of all to locate. Successful efforts were made to interview a large proportion of these young people. In addition, information was gathered from parents on their 1,480 children living away from the household of origin (Clay and Vander Haar, 1989).

Once data were collected, very careful verification and editing was done to identify and correct possible errors and in-consistencies in responses.

Topics covered in the questionnaire are as follows:

a. Demographic characteristics of all household members including migrant children.

b. Non-farm and off-farm employment of all households members.

c. Permanent and temporary migration patterns of selected household members.

d. Fertility behavior.

e. Plans and preferences of all adult household members regarding access to land and family size.

f. Economic support networks between the household and members of the extended family living elsewhere.

g. Sources of household income.

h. Physical characteristics of the farm and residence.

i. Hired farm labor.

j. Aspirations and opinions of parents and adult children regarding non-farm training and employment and the future of young people in farming.

Limitations of Survey Research.

Survey research has been a common method of sociological inquiry for the last few decades. At times studies based on the results of survey research occupy more than three quarters of the space in professional sociological journals (Wells and Picou, 1981). Various social scientists have strong opinions about the strengths and use of survey research methods (Babbie, 1990; Bainbridge, 1989; Rosenberg, 1968; Rossi et al., 1983;). Some express strong criticisms. Such criticisms have often been shown valid in surveys conducted by the respective governments and international donor agencies who are eager to prove their achievements. The reliability and validity too of traditional survey

methods in developing countries has been questioned by many, e.g., Chambers (1983). participatory action researchers in particular are more critical of survey research (Hall, 1983). It has been argued that relying upon these methods in the analysis of complex issues like fertility falsifies the facts and misleads the social scientist. Sometimes, the data are further falsified by the government officials whose jobs depend upon their achievements (Chamber, 1983).

One example of such misleading results is given by Mamdani (1972) in his classic example quoted below. In response to his question to a villager who accepted birth control pills and never let his wife use them and was most probably counted as one of the family planning program acceptors in India, he said:

> But they were so nice, you know. And they came from distant lands to be with us. Couldn't we even do this much for them? Just take a few tablets? Ah! even the gods would have been angry with us. They wanted no money for the tablets. All they wanted was that we accept the tablets. I lost nothing and probably received their prayers. And they, they must have gotten some promotion. pp 23.

Regardless of these problems, the advantages of survey research cannot be denied. Its efficiency, economy, and coverage are the most important strengths which are often non-existent in other methods used in sociological inquiry

including field methods, content analysis, experimental, and archival research.

Limitations of the data

The non-farm Strategies Survey was designed to examine the various alternatives open to farm households in Rwanda outside of their own farm production. Non-farm employment, patterns of permanent and temporary migration, and fertility reduction were among the more important alternatives studied. Although the relationship between landholding and fertility is germane to the notion of non-farm strategies, it did not constitute the primary focus of the study. Thus the study is partially limited by the data in its treatment of the question. In particular, the number of living children, our major dependent variable is not a count of actual children ever born. Data therefore carry the danger of under-count due to infant mortality.

Other general problems of survey research arise at various stages of the research process, notably: 1) phrasing of questions; 2) presentation by the interviewer; 3) perceptions of the respondent; and 4) recording of responses. Since highly skilled local and international professionals planned and supervised the execution of data collection activities of this survey, I believe that these errors have been minimized.

In spite of efforts on the part of the design and field staff, data collected through surveys pose various other problems. These are generally of two types: 1) problems arising from questions about the respondent's behavior, or facts relating to the past or present, and 2) problems arising from questions about the respondent's psychological states, attitudes, opinions, and desires (Sudman and Bradburn, 1982). Type 1 problems (respondent's recall) are a result of memory lapse or intentional denial of facts which can often be probed by a skillful interviewer. Type 2 problems arise from unverifiable statement of the respondent on any issue. Type 2 problems are more difficult to handle as compared with Type 1. For example, the question "How many sons and daughters do you have?" is not problematic as compared with the question "How many sons and daughters do you desire to have?". These problems are discussed in greater detail in the following sections on the operationalization of key study variables.

Operationalization of Key Study Variables

1. Access to Land.

Access to land is defined as the total amount of land operated by the farm household, measured in square meters. The measurement of land was done by the research staff using measuring tapes and other equipment. I know

whether or not farmers are renting land but the estimates are for total operational holdings and do not differentiate between owned and rented land. Moreover, I do not know how much land is rented out, which in some cases may be more than the land in operation. The additional income from this source may have a strong influence on the major dependent variable, fertility, and other intervening variables. However, the evidence from these data indicates that the sample does not include many such cases.

2. Age of Husbands and Wives

This variable is defined as the current age of the respondent. Until very recently, the date of birth of children was not recorded in many developing countries. Rwanda is not an exception. The accuracy of responses to this question is based on the memory of the respondent and on the probing skills of the interviewer. Hence, there may be small in-accuracies.

3. Education of Husbands and Wives

This was a closed-ended question with the categories as follows, 1) no schooling, 2) incomplete primary, 3) primary complete, 4) post primary (CERAI), 5) secondary incomplete, 6) secondary complete, 7) higher education. Apparently the data obtained do not pose any special problems.

4. Temporary Migration of the Husband

This was an open ended question on total number of days, weeks or months that heads of households were away from the household temporarily employed over the course of their lifetimes. Since the answer was based on the recall of the respondent and on the probing skills of the interviewers, I suspect that there may have been some uncertainty, especially on the part of the older heads, regarding their earlier migrations.

5. Wife's Age at Marriage

The question sought woman's age at marriage. Although this question, too, is based on memory of the respondent, it is believable that in most cases the response is probably valid, particularly for younger wives.

6. Wife's Labor Force Participation

This variable is defined as total days of off-farm/non-farm labor engaged in by the wife over the previous three month period. By multiplying by a factor of four this variable was annualized. Evidence from the 1984 national Survey of Agriculture indicates that non-farm employment, at least at the household level, does not show significant variations from one season to the next (SESA, 1986).

9. Fertility

The principal dependent variable is measured as the number of living children born to the head of household and either presently or formerly living in the sampled household. It is not an indication of the total number of children ever born, since deceased children are not counted. Since the aim of this study is to explore the land-labor and land-security hypotheses, which are generally applicable only to older, adult children, the number of children ever born would be a weak measure, especially because the infant mortality rate in Rwanda is as high as 122 per 1000 births (Population Reference Bureau, 1990).

Opinions Regarding Fertility Behavior

Also examined are the opinions of husbands, wives, and children regarding their own fertility behavior and, in the case of parents, of their children's fertility behavior. Decades of research have shown that gathering and analyzing data on opinions and attitudes, especially on the subject of reproductive behavior can be susceptible to special measurement problems.

Attitudes, opinions, and beliefs all refer to psychological states that are self-reported by the respondents and cannot be verified or tested (Sudman and Bradburn, 1982). Questions targeted to measure opinions, desires, or trends are the most problematic questions in any

survey research (Martin, 1983; Rider and Westoff, 1965; Sudman and Bradburn, 1982) . Listed below are some of these general problems indicated by Martin (1983) and Sudman and Bradburn (1982).

1. An opinion or expression of fact given by the respondent may be influenced by the interviewer. This can be more serious in developing countries where interviewers are (or are considered to be) government representatives and respondents consequently tend to please them.
2. Social desirability is always in the mind of the respondent when answering questions.
3. If there are incentives associated with one type of opinion it can easily influence a response.
4. Style of interviewing, level of training and experience, and the personal biases of interviewers can seriously influence the opinions of respondents.
5. The wording and context of a question, and the treatment or translation of vague or ambivalent answers by the interviewer can lead to a modified opinion.
6. Multiple concepts in a single question (double barreled questions) may also influence the opinion of the respondent.

Ryder and Westoff (1965) have suggested that in the United States, opinions on the desired number of children have been a reflection of actual fertility. However, they

identify the following possible problems which may arise during any opinion survey on fertility:

1. The desired number of children varies with the age of the respondent.
2. Age at marriage can also influence the opinions of respondents on desired number of children.
3. Meaning and the order of the questions on the desired number of children may alter the responses on opinions.
4. Desired number of children reported by a cohort at time A may not be true to a cohort at time B because change takes place in all other variables.

Fertility Opinions in Rwanda.

As part of the Rwanda Non-farm Strategies Survey, a small set of fertility-related opinion questions were asked of husbands, wives, and adult children living in the household. These questions probe at: 1) satisfaction with available land, 2) possible strategies if land is not sufficient, 3) problems arising from faster population growth, 4) ideal and desired number of children by parents and adult children, and 5) recommended number of children suggested by parents to next generation, and desired number of children by adult children. Following is a brief discussion of these opinion questions and their potential shortcomings:

1. The question directed to husbands, wives, and adult children (both sons and daughters) was on the sufficiency of land. The first question (that directed to the head of household) was: "Do you consider the landholdings to be inherited by your children sufficient for the needs of your children's families". The question carries various problems including: 1) Perception of the notions of 'sufficient for the needs', 2) Since the children have not completed their fertility the estimate of need is artificial, 3) The respondent does not know other structural changes which may take place in due time. Hence, the answer to this question is very hypothetical. The second question was asked of the children: "Do you think you will inherit enough land for your own family's needs?". There are two problems underlying this question: 1) They do not know specially how much land and how many children they will have in future and 2) They cannot foresee the future and cannot determine if the land would be enough for the next generation. Answers to both of these questions may also be somewhat hypothetical. However, the question still gives some information about how children feel about the relationship between land and their future fertility.
2. In the event that children or parents did not think that land was enough, a follow up question was asked

regarding future plans: "If you do not have sufficient land, what do you plan to meet the needs of your household?". The question was followed by various structured responses. In response to a structured question like this, each respondent is forced to pick one of the suggested strategies. In reality, they involve themselves in multiple activities for survival. No such category was provided to the respondents in this question. Moreover, parents in rural areas of developing countries tend not to migrate for non-agricultural work. It is assumed that their children will look for different jobs if land is not enough. Hence, parents' responses to this question might be a response on behalf of their children.

3. Problems reported by the parents for themselves and their children as a result of rapid population growth was another closed-ended question phrased as: "What is the main problem for your household caused by rapid population growth?" with possible answers of: 1) Insufficient land, 2) Food shortage, 3) Insufficient jobs, 4) No problem, and 5) Other problems (open ended). As mentioned above, the response to this question heavily depends upon how the question was presented by the interviewer, how it was perceived by the respondent, and how it was recorded. Although there is always a possibility of interviewer bias, I do not have any

reason to believe that this was the case in this question.

4. There were few questions directed to heads of household and children on ideal and desired number of children. The question directed to heads asked: "If you want to have more children, how many?". The question to children asked: "How many children would you like to have when you are married?". As suggested by Ryder and Westoff (1965) and others, the ideal number of children is a very hypothetical opinion question. The response heavily depends upon the social setting up in which the interview takes place. My own observations as an interviewer in various surveys in Pakistan suggests that respondents always try to please the interviewer by giving a favorable answer. This is not because they lie but because they want to be polite. This question, in my opinion, is more meaningful in an industrial country when directed to educated people who have an access to family planning methods.

5. Recommended number of children to the next generation by parents poses the same problems indicated for the previous question. The question reads as: "What advice would you give to your children and relatives about the ideal number of children in their households?".

All of these problems are invariably present but not always apparent in survey research. In most cases there

is very little that can be done to overcome them. The present study is not unique in manifesting or having to deal with such problems.

To sum up, the Non-farm Strategies Survey carries the following limitation: 1) The primary focus of the survey was not to examine the relationship between landholding and fertility, and thus partially limits the treatment of the question; 2) Number of children, the major dependent variable, indicates number of living children, not a count of actual children ever born; 3) The opinions recorded by the survey carry the usual problems of reliability and validity. Alternatively, these problems are tempered in the context of this study for the following reasons: 1) The survey covers a wide variety of questions dealing with the relationship between landholding and fertility; 2) The number of living children does not pose any serious problem for the purposes at hand because infant mortality is more or less equally distributed among all rural sectors of Rwanda; and 3) The problems associated with opinion research are not unique to this particular survey. I can therefore be concluded that in spite of these limitations, the Non-farm Strategy Survey provides an interesting and a reliable data set with which to explore the relationship between landholding and fertility in Rwanda.

Weighting of Data

In the sample communes with highly dense populations are over-represented. A weight command will adjust this problem. Thus, all data represented in the analysis are appropriately weighted to compensate for such variation in sampling fractions.

CHAPTER 6

DATA ANALYSIS

The objectives of this study, broadly speaking, are to examine: 1) The relationship between landholding and fertility, 2) The validity and applicability of the land-labor and land-security hypotheses in the African context, and 3) Fertility/family size opinions among Rwanda's parents and young adults. Previous chapters have reviewed the conceptual and theoretical underpinnings of these focal areas; this chapter considers their empirical context using data derived from the Rwanda Non-farm Strategies Survey. There are three sections. In the first section, data are presented and analyzed for the entire sample of 1,019 households. The relationships posited, illustrated by Figure 5, are carefully examined, both individually and collectively. In the second section the sample is divided into two sub-groups, namely: those who both own and rent land (owner-renters), and those who operate only their own land (owners). The aim is to analysis is to isolate the effect of land ownership on fertility. In the third section, data on the opinions of parents and their children about family size are presented and analyzed.

SECTION 1

LANDHOLDING AND FERTILITY

The conceptual framework outlined by Figure 5 illustrates the complex of interrelationships among the key variables being examined. Included are the following variables: 1) Husband's age, 2) Husband's education, 3) Wife's education, 4) Wife's age, 5) Landholding, 6) Wife's age at marriage, 7) Wife's participation in the labor force, and 8) Temporary migration of the husband. I will report here how the mean number of children that couples have is influenced by these variables. In addition, the following indirect effects on fertility will be explore: 1) The effect of husband's age through his migration and landholding, 2) The effect of husband's education through his migration and landholding, 3) The influence of education of wife through her age at marriage, and 4) The effect of wife's age through her participation in the labor force. Finally, zero-order correlations and betas will be used to determine the direction and magnitude of these effects.

Tables 4 and 5 report summary statistics and frequency distributions for selected key variables. The data show that, on average, education levels are very low in

Table 4. Descriptive Data For Key Study Variables.

Variables	Descriptive Statistics
Education of Wife	25.4% Some schooling, 7.4% Primary+
Education of Hus.	38.3% Some schooling, 16% Primary+
Wife's Age at Marr.	19.5 Years (range 14-38)
Wife's Lab. Force	72.3 Days/year (range 0-360)
Temporary Migrat.	602.1 Days (range 0-9,490)
Age of Wife	39.6 Years (range 18-79)
Age of Husband	45 Years (range 23-88)
Fertility	4.9 Living children (range 0-13)
Land Holding	1.3 Ha (range .03-14.2)

Rwanda for both men and women. A full two thirds (67.2%) of the women and 45.6% of these men have received virtually no formal schooling. These rates are confirmed by the United Nations, in 1987, which reported for the entire population of Rwanda over 15 years of age that 73.4% of women and 49.25% of men had no schooling (United Nations, 1989). Percentages completing primary and post-primary schooling are 7.4% for women and 16.1% for men, one of the lowest in the world. However, literacy rates in Rwanda are not among the very lowest in Africa. Compared with many other African nations such as Algeria, Benin, Burkina Faso, Ghana, Liberia, Mali, and Togo, Rwanda's accomplishments in terms of national

Table 5. Key Study Variables (Percentage Distribution)

Variables	Percent
Landholding	
.5 ha - less	21.7
.5 ha - 1.00	32.4
1.0 ha - 2.00	25.9
2.0 ha - above	20.0
Total	100.0
(N=)	(747)
Fertility	
0 - 2	16.7
3 - 4	29.6
5 - 6	26.7
7 - 13	27.0
Total	100.0
(N=)	(747)
Wife's Age at Marriage	
14 - 17	24.7
18 - 20	48.2
21 - 38	27.1
Total	100.0
(N=)	(711)
Education of Wife	
No Schooling	67.2
Incomplete Primary	25.4
Primary Completed	6.3
Post Primary	1.1
Total	100.0
(N=)	(744)
Education of Husband	
No Schooling	45.6
Incomplete Primary	38.3
Primary Competed	12.9
Post Primary	3.2
Total	100.0
(N=)	(744)

education are not as dismal as might first appear (United Nations, 1989). On the other hand, Angola, Botswana, Cameroon, Congo, Egypt, Ethiopia, Libya, Somalia, Togo, Tunisia, and Tanzania have higher literacy rates than Rwanda (United Nations, 1989). Yet the frequencies reported above still suggest that a large proportion of population in Rwanda, like many other nations in Africa, receive no schooling at all.

Women play a very significant role in farming in Africa. It has been estimated that in some countries up to 80% of the agricultural work force consists of women (FAO, 1985). Other estimates suggest that they perform up to 75% of agricultural work. Data from World Fertility Survey indicate that out of all married women aged 15-49 in Africa, 19.2% in Egypt, 19.3% in Morocco, 20.4% in Tunisia, 29.3% in Mauritania, 34.5% in Sudan, 65.5% in Cameroon, 72.2% in Senegal, 75.7% in Ivory Coast, 77.8% in Benin, and 89.8% in Ghana were actively involved work in farm and non-farm work (U.N., 1985). Unfortunately there are not many studies which capture women's actual work in farming in terms of hours. Similarly women play a significant role in non-farm activities. Again, it is very difficult to measure their actual time spent in non-farm activities in Africa (World Bank, 1980). The participation of women in non-farm activities as compared to men, however, has been limited because of cultural constraints and few available jobs. This

data indicate that women in Rwanda work an average of 72.3 days a year in non-farm activities including, but not limited to, brewing of traditional beverages, making clothing, and basket making.

In most developing countries men are being forced by the push factors to find alternative jobs in urban sectors. In most cases, they stay away from their homes for such temporary jobs. Men in Rwanda, are absent from the home due to temporary, seasonal migration over 600 days on average during the course of their lifetimes. This migration in general is for non-farm activities. Data from other parts of Africa suggest that Nigeria (227), Ghana (102), Togo (107), and Benin (188) are among the African countries with the highest per thousand population working in the non-farm sector. Chad (10), Rwanda (28), Senegal (26), Mali (30), Malawi (46), are among the countries with the smallest non-farm rural work force (World Bank, 1987).

According to data collected through the World Fertility Survey, Africa has the lowest average age of marriage for women. Cameroon with an average age of 17.5 years is at the top of the list followed by Senegal (17.7), Ivory Coast (17.8), Benin (18.2), Mauritania (19.2), Ghana (19.3), Kenya (19.9), Morocco (21.3), Sudan (21.3), Egypt (21.3), and Tunisia (23.9)-(U.N. 1985). According to the data, wife's age at marriage in Rwanda is very low. This age is 19.5 years with marriages as early as 14 years of age.

Compared with many other countries in Africa, average landholdings is very small in Rwanda. In countries such as Nigeria, because of an abundance of available land, the government has been encouraging farmers to operate government owned land in northern Nigeria but has had difficulty finding interested farmers. The topography of Rwanda, however, provides limited land for farming. Hence land is scarce and couples operate approximately 1.3 hectares (13,079 m2) of land on average, and there is a continuous struggle to acquire more land for family needs.

Data on human fertility place many African nations among the highest in the world. This finding is evident in Rwanda where on average couples have 4.9 children. More than 50% of married couples reported more than five living children. In fact, current total fertility rate of Rwanda (8.3) is the highest in the world. It is higher than many other African countries such as Egypt (4.4), Ghana (6.4), Nigeria (6.5), Kenya (6.7), and Uganda (7.4), all traditionally high- fertility countries (Population Reference Bureau, 1990).

In summary, data presented by Tables 4 and 5 confirm that married couples in Rwanda are characterized by small landholdings, high fertility, low schooling, early age at marriage, minimum participation of women in non-agricultural activities, and some temporary out-migration of men for work. These characteristics of Rwandan farm households reaffirm the

notion that landholding is at the very core of existence for this subsistence population. As a result of low literacy and education levels, limited non-farm employment, and fewer opportunities to work in the industrial urban sector, Rwandans have little choice except to work on their farms. Mechanization of agriculture is not feasible because of very small landholdings. As a result, manual labor remains the norm for virtually all agricultural activity in this highland African country. The demand for labor at the household level is met by most farm couples by increasing their fertility.

Table 6 reports the mean number of children born to couples classified by other variables in the model and helps to gauge their influence on fertility in Rwanda. The influence of landholding on fertility is reflected by a gradual increase in the number of living children farm couples have with an increase in landholding. Farmers who operate less than .5 hectares of land report 3.62 living children, as opposed to those who operate 2.0 hectares or more and who have an average of 5.88 children. Thus, these data suggest that there is a significant increase in number of children couples have as their landholdings increase (eta=.33) and vice versa. This conclusion supports the perception most commonly exhibited in the literature that parents in agrarian societies make rational decisions about their fertility. This rationality derives from the level of demand for children in any society. If the demand for

Table 6 Mean Number of Children by Key Study Variables

Variables	Mean Number of Children	(N=)
Landholding		
.5 ha - less	3.62	156
.5 ha - 1.00	4.56	239
1.0 ha - 2.00	5.55	204
2.0 ha - above	5.88	148
Total	4.90	747
Eta = .33		
Sig = .00		
Wife's Age		
18 - 29	3.03	226
30 - 39	5.64	374
40 - 49	5.89	147
Total	4.90	747
Eta = .50		
Sig.= .00		
Wife's Age at Marriage		
14 - 17	5.36	176
18 - 20	5.07	340
21 - 38	4.41	199
Total	4.96	715
Eta = .15		
Sig.= .00		
Wife's Education		
No Schooling	5.12	501
Incomplete Primary	4.65	188
Primary and Higher	3.85	55
Total	4.91	744
Eta = .14		
Sig.= .00		

Continued on next page.....

Variables	Mean Number of Children	N=
Husband's Education		
No Schooling	5.01	343
Incomplete Primary	4.72	282
Primary and above	5.04	119
Total	4.99	744
Husband's Age		
< - 30	2.69	113
31 - 50	5.05	391
51 - >	5.72	243
Total	4.90	744
Eta = .41		
Sig = .00		
Migration Days of Husband		
0	4.92	321
1 - 180	4.37	155
181 - 730	4.83	119
731 - 9490	5.45	152
Total	4.90	747
Eta = .14		
Sig.= .00		
Female Labor Force Participation		
0	4.82	376
1 - 120	5.06	205
121 - 360	4.88	166
Total	4.90	747
Eta = .04		
Sig.= .52		

children is high, parents produce more children. If, on the other hand, demand for family labor is low, they will lower their fertility. In societies, where the average size of farm is significantly larger, farmers tend to mechanize their agriculture as a substitute for increasing their family labor pool (Becker, 1960, 65; Becker and Lewis, 1973). As mentioned above, the average landholding in Rwanda is only 1.3 hectares per household with some households operating as little as .03 hectares. With such small holdings, mechanization at the household level is not feasible. However, some countries such as China, Cuba, and India have tried some cooperative farming where farmers were provided both with inputs and agricultural machinery in return for a share in the produce. Such arrangements reduces the demand for manpower, leading to a negative effect on fertility. Since cooperatives are not very common in Rwanda, family labor remains the most obvious response to meeting the higher demand for labor. Raising children is inexpensive in agrarian societies relative to their potential return (Cain, 1986); and their economic and psychological utility is life-long (Caldwell, 1986; Stokes et al.; 1986); thus, the logical response to the increased demand for labor in countries like Rwanda is to increase fertility. This conclusion is consistent with research findings discussed earlier, including those reported by Ajami (1976) in Iran; Arnold and Pejaranoda (1977) and Chalamwong et al. (1979) in Thailand,

Clay and Johnson (1990) in Rwanda; Connell (1965) in Ireland; Demeny (1968) in Austria; Driver (1963) in India, Forster and Tucker (1972) in the U.S.; Odell (1982) in Guatemala; Schutjer et al. (1983) in Egypt; Tuladhar et al. (1982) in Nepal; Easterline (1976); Hawley (1955) in Central Luzon; Prasithrathsin (1971) in Thailand; Shapiro (1982) in the U.S.; and Stoeckel and Chowdhury (1980) in rural Bangladesh all of whom have reported a positive relationship between landholding and fertility.

The relationship between number of children and age of wife suggests that an increase in the wife's age leads to an increase in fertility in Rwanda. Women in the age bracket 18-29 years report having 3.03 children as compared to 5.89 children reported by women between the ages of 40 and 49 years. This observation suggests that Rwandan couples tend to achieve a natural fertility regime as they age. Since they abstain from any interfering devices (including all birth control methods) to achieve natural fertility their total fertility is higher than in any country in the world. Infant mortality, on the other hand has declined in Rwanda in recent decades resulting in one of the world's highest population growth rates. This observation refers back to the earlier discussion of demographic transition theory, which suggests that transitional societies experience faster population growth as a result of constant higher fertility and declining mortality. Continuous higher fertility in

Rwanda as a result of the natural process of aging can be attributed to the kinds of socio-cultural, economic, medical, and administrative changes discussed earlier.

The data further suggest that wife's age at marriage is another important determinant of fertility in Rwanda. Average fertility for early marriages (ages 14-17) is 5.4 while those women who marry later on in life (ages 21-38) exhibit a fertility rate of only 4.4 children. This pattern closely resembles other regions of the world where age at marriage is negatively associated with fertility through its diminished effect on the number of reproductive years (Smith, 1983; Udry and Cliquet, 1982). Parents in most under-developed and developing countries prefer that their daughters marry at an early age, and this is strongly influenced by a variety of socio-cultural and religious forces. Almost all religions of the world preach early age at marriage for young women. One can find various quotations from religious writings in support of this phenomenon. The following quotation from the Hadith[3] is an example from the Islamic world:

> "Arrange the marriage of your children when they are young (age of puberty and menstruation) and save the Islamic nation from adultery".

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[3]. Hadith is a collection of the sayings of prophet Muhammad.

Such statements from religious authorities act as a driving force behind the early age at marriage in Africa and other parts of the world, leading to an expansion in the reproductive period of women and resulting in higher fertility.

It is worth mentioning that education and urbanization moderate religious beliefs everywhere, including Sub-Saharan Africa where improved education and greater urbanization are increasing the age at marriage. However, the increase in the average age at marriage in most African countries is not leading to greatly lowered fertility. This phenomenon is explained by Bongaarts et. al (1984) who suggest that educated and urban women in sub-Saharan Africa are shortening their breastfeeding and avoid sex after delivery for shorter periods, which were two traditional methods of lowering fertility in this part of the world. On the other hand, they still make little use of contraceptives, which increases their fertility despite the fact that they tend to marry later.

Moreover, in a country such as Rwanda, early age at marriage is a consequence of the general socio-economic circumstances of women. Women in Rwanda are characterized by: 1) A low rate of literacy, 2) Very low education, 3) Little non-farm employment, and 4) Extreme male domination, all of which force them to marry at an earlier age and play the traditional role of bearing and raising children.

Table 6 further suggests that wife's education suppresses fertility in Rwanda. The number of living children for women declines to 3.85 for women with primary or higher education, from 5.12 for women with no schooling at all. This finding is consistent with other studies which suggest that education: 1) provides an opportunity for women to work in the non-traditional work force, 2) exposes women to modern ideas and information about family planning programs, and 3) eventually begins to detach women from their traditional responsibilities of keeping house and raising children, all of which lead to a negative relationship between mother's schooling and fertility (Casterline, 1985; Courbage, 1984; Jain, 1981; Pol, 1983; Sathar, 1984). Since, only 7.4% of all wives in Rwanda have completed primary school, the overall effect of this variable may be less dramatic than in other countries where the educational system is more developed. Nonetheless it can be concluded from this negative relationship that the mass education of women, which according to Caldwell (1980, 1988) produces a negative effect on fertility, even in the absence of other socio-economic changes, will produce the same pattern of influence in Rwanda as in other regions of the world.

Variables that appear to have little influence on childbearing in Rwanda are husband's education, the amount of time husbands spend away from home due to temporary migration, and female participation in the labor force. With

the exception of husband's education, these results contradict the findings of other studies in other regions of the world where these variables have all exhibited negative effects on fertility.

Education of the husband in most regions of the world tends not to affect fertility one way or the other. One suspects that other socio-economic forces overshadow the effect of husband's education in developing societies. Moreover, it is the woman who is more directly involved in bearing and rearing children, thus it is not surprising that a wife's education generally outweighs husband's education in its influence on fertility behavior.

According to Mead Cain (1985) temporary migration for work tends to lower fertility as a result of the separation of spouses. A similar observation can be made in Pakistan where army personnel and overseas migrant workers tend to have lower fertility because they are not accompanied by their spouses, thereby lowering the likelihood of conception. However, this barrier seems to have little effect in Rwanda. Probable reasons for this phenomenon include: 1) current migration patterns in Rwanda are regional, not national, which reduces the chances of separation of spouses, 2) in the past most migration has been rural to rural which does not detach the husband from his traditional rural values, 3) despite frequent migrations the husband keeps his strong ties with the household and pays

frequent visits (Clay and Ngenzi, 1989). Thus, migration in Rwanda does not break the physical, emotional, and cultural link of husband with his spouse and household and therefore does not effect fertility.

Female labor force participation is another variable which does not seem to have an effect on fertility in Rwanda. In other regions of the world it has been considered as a strong determinant of declining fertility (Courbage, 1984; Cutright and Polonko, 1977; Freshnock and Cutright, 1978; Happel et al., 1984; Jones, 1981; Mincer and Polacheck, 1974; Semyyonov, 1980). However, most of this literature has focused on the participation of women in the industrial labor force in urban settings. Women in Rwanda generally work in cottage industries and other non-industrial sectors, allowing them to maintain strong ties with the home and family, and to support traditional values and culture. Therefore, existing labor force participation of women in Rwanda, unlike many other regions of the world, has virtually no effect on the fertility behavior of Rwandan women. The data even suggest a slight increase in fertility for those women who participate more actively in the labor force. Undoubtedly these women are economically better off than those who are not employed off the farm, which in turn increases the survival rate of their children and higher fertility when measured as the number of living children. Moreover, contrary to the local customs, educated women in

Rwanda tend to reduce or abandon breast feeding and start early sexual relations after delivery resulting in higher fertility than in the past (Bongaarts, 1984). These factors, therefore, dominate the usual negative effect of education on fertility.

Effect of Intervening Variables on Fertility

Since landholding has a positive association with the number of children couples have, it seems reasonable to suggest that some of this relationship may be a result of the indirect effects of other variables in the model, namely the husband's age and educational level. The findings presented in Table 7 suggest that landholding is indeed positively associated with the number of children couples have, as well as the age and education of the husband. As mentioned earlier, landholding in Rwanda and in other rural societies is a symbol of power and socio-economic status. Rural people, therefore, tend to acquire more land whenever it is possible. The possibility of acquiring more land increases as incomes grow. Incomes in rural societies, unlike urban industrial societies, tend to increase with age. This potential of making more money in older age comes through various skills they acquire overtime and their physical strength to work for longer hours. However, it starts declining when people get older and eventually retire. Another strategy of increasing income for rural families is

through the attainment of higher levels of education. Education in a country with a very low literacy rate opens the doors to many new job opportunities and the potential for increased household incomes. Age and income, therefore, provide greater access to land. And this is undoubtedly the reason why a positive relationship between these variables and landholding has emerged in this context. It therefore can be inferred that the positive relationship between landholding and fertility is enhanced by the indirect positive effects of age and husband's education.

The reverse hypothesis suggests that higher landholding is a result of higher fertility. However, it has already been reported by Clay and Johnson (1990) that it is size of farm which determines fertility in Rwanda not the reverse. I, therefore, can infer that in Table 7 it is not the number of children that leads households to acquire more land, rather it is landholding that leads to higher fertility because a majority of the couples operated their present landholdings prior to the birth of their children. However, as reported by Clay and Johnson (1990), it is important to mention that higher landholding may have some negative effect on infant mortality leading to a relatively higher number of surviving children.

It was hypothesized in the building of the theoretical model that the age at which women marry is influenced by their levels of education. Table 8 suggests

Table 7. Mean Landholding by Number of Children, Age of Husband, and Education of Husband.

Variables	Mean Landholding	(N=)
Number of Children		
0 - 2	1.97	129
3 - 4	2.23	222
5 - 6	2.53	198
7 - 13	2.97	198
Total	2.46	747
Eta = .35		
Sign.= .00		
Age of Husband		
15 - 30	1.96	113
31 - 50	2.38	391
51 - >	2.82	243
Total	2.46	747
Eta = .28		
Sign. = .00		
Education of Husband		
No Schooling	2.32	343
Incomplete Primary	2.52	282
Primary and above	2.72	119
Total	2.46	744
Eta = .14		
Sign.= .00		

that wife's age at marriage is not influenced by landholding. Although the pattern of influence of education of wife on age at marriage is supportive of the existing positive association of education and age with the age at marriage reported in other studies (Caldwell, 1982), it is not strong enough to be either theoretically conclusive or statistically significant. Most probably this insignificant effect of education in delaying marriages is a result of the very strong pro-natal socio-cultural conditions found in rural Rwanda. Thus, it can be inferred that a wife's education does not have an indirect effect on fertility through her age at marriage.

Temporary Migration

As discussed earlier, Mead Cain has reported from his research in Bangladesh that the temporary migration of husbands for work suppresses fertility in that country. In the model it was posited that the migration of husbands would be influenced by the husband's age, his education and landholding. These hypotheses were conceived on the notion that: 1) the age and education of the husband would enhance his chances in the urban job market and act as pull factors for migration, 2) scarcity of land reduces his chances of making a living in farming and acts as a push factor for him to migrate, and 3) an outcome of this migration would be separation of spouses, which in turn would lead to a lower

Table 8. Wife's Mean Age at Marriage by Education

Variables	Wife's Age at Marriage	(N=)
Education of Wives		
No Schooling	19.42	475
Incomplete Primary	19.66	183
Primary and above	20.17	54
Total	19.54	712
Eta = .07 Sig. = .18		

fertility.

Table 9 illustrates that both the age and education of husbands increases the likelihood of their migration for temporary work. The majority of the migrant workers fall in the age bracket of 31-50 years. The table further suggests that minimum life time work days (153) as a migrant was reported by people under the age of thirty years. The maximum days (884) , on the other hand were reported by the rural Rwandans who were more than 51 years of age. The influence of education on migration is reflected in the table by the fact that primary or more education approximately doubles the chances to migrate for rural Rwandans compared to when they have some or no schooling. These findings indicate that age of husband and their education (as low as

primary) opens new job opportunities for Rwandans which are not available in their native places. Thus, they tend to migrate to other places. Landholding, however, has no effect on migration. However, if farmers who operate less than 0.5 hectares of land are excluded, there is a trend of higher migration with higher landholdings. This positive association of land with migration can be explained by the fact that couples with more land are economically better off and have resources to migrate. Moreover, they can afford the risks of failure at the receiving end. Finally, larger holdings are positively associated with higher education, which is a strong determinant of migration for temporary work. This situation reflects the classic J-curve that the poor are pushed to migrate and the rich are pulled due to education. However, as reported in Table 6, there is no significant relationship between temporary migration of husbands and fertility in Rwanda which suggests that the indirect effect of these variables on fertility is not likely. Although these observations are contrary to Mead Cain's findings, it can still be assumed that if the migration of husbands can actually separate spouses for long periods of time it may still bear the same results reported by Cain in Bangladesh. Moreover, the measure of migration is flawed because it indicates the migration days over the husband's entire life time. It is quite possible that a comparison of migrant and non-migrant adults in the

Table 9. Migration Days of Husband, by Age of Husband, Education of Husband, and Landholding.

Variables	Mean Days of Migration By Husband (Mean)	(N=)
Age of Husband		
15 - 30	153	113
31 - 50	557	391
51 - >	884	243
Total	602	747
Eta = .18		
Sign.= .00		
Education of Husband		
No Schooling	551	343
Incomplete Primary	535	282
Primary and Above	921	119
Total	604	744
Eta = .11		
Sign.= .02		
Landholding		
0 - .5 ha	580	156
.5 - 1.0	487	239
1.0 - 2.0	655	204
2.0 > ha	739	148
Total	602	747
Eta = .07		
Sig. = .28		

reproductive age might bear different results.

Labor Force Participation of Farm Women

Research in many regions of the world reports that female labor force participation has a negative effect on fertility (Cutright and Polonko, 1977; Happel et al., 1984; Jones, 1981; Mincer and Polacheck, 1974). This decline in fertility takes place because: 1) economic incentives change the priorities of women, 2) employment gives economic power to women, giving them a greater role in decision making about the timing and number of births, 3) children become an economic liability to working women, and 4) the work place provides an opportunity for women to interact with other people and reevaluate some of their traditional attitudes and beliefs, notably those relating to fertility behavior. It was posited earlier that the age and education of wives in Rwanda would have an indirect effect on fertility through their labor force participation. Table 10 suggests that younger women tend to spend more time in the non-farm labor force, and that wife's education is a major determinant of female labor force participation. These results are typical of those reported in other regions of the world. However, since female labor force participation does not influence the number of children Rwandan parents have, it can be inferred that there is no indirect effect of age of wife on fertility

and that education of wife does not affect fertility indirectly through labor force participation.

In summary, the following generalized conclusions can be drawn from the above review of findings: 1) size of landholding, age of husband and wife, and migration days of husband have a positive effect on fertility; 2) Wife's age at marriage and wife's education are negatively associated with fertility; and 3) Husband's education and female labor force participation do not influence fertility. For the most part, these findings are consistent with the findings reported for studies done elsewhere in the world.

Although the conclusions drawn give a general understanding of the relationship of each independent variable to fertility in Rwanda, they do not tell whether any of the observed influences can be sustained when brought together in the same multivariate model. This is a subject to be addressed in the following section.

Multivariate Model

The direct and indirect effects of variables in the model are presented in Table 11. Looking first at the zero-order correlations between fertility and the array of independent variables, I see a pattern of relationship that is virtually identical to those discussed in the previous section. First, the data indicate that landholding is positively associated with fertility (r=.31); those with more

Table 10. Wife's Labor Force Participation (days/year) by Age and Education of Wife.

Variables	Wife's Labor Force Participation (days/year)	(N=)
Age of Wife		
18 - 29	89.1	226
30 - 39	70.0	374
40 - 49	52.3	147
Total	72.3	747
Eta = .12		
Sig. = .00		
Education of Wife		
No Schooling	62.8	501
Incomplete Primary	86.2	188
Primary and Higher	104.5	55
Total	71.8	744
Eta = .13		
Sig. = .00		

land have more children. Age of wife, age of husband, and temporary migration are other variables that show a positive association with fertility (r = .41, .35, .11). As expected, wife's age at marriage and wife's education are negatively associated with the number of living children (r= -.17, -.14). All of these relationships are significant at the .01 level. The remaining two independent variables, female participation in the labor force and husband's education are virtually unrelated to a couples' fertility behavior (r = -.00, .03).

Table 11. Zero Order (r) and Partial (beta) Correlations between Independent Variables and Fertility (Number of Living Children)

6 Independent Variables	Fertility (r)	Fertility (Beta)
Education of Wife	-.14*	-.01
Wife's Age at Marriage	-.17*	-.22*
Wife's Labor Force Part.	-.00	.02
Migration Days	.11*	.04
Age of Wife	.41*	.40
Age of Husband	.35*	-.02
Education of Husband	.03	.06
Landholding	.31*	.22*
R square		.27

(N = 715)
* Sign. = .01

Also reported in Table 11 are the beta coefficients, estimates from a multiple regression equation using the same set of variables. Of the six significant relationships observed at the zero-order level, only three hold up in the multivariate model and, not surprisingly, two of these are the wife's age and her age at marriage (beta = .40, -.22) -- variables that have a direct and obvious effect on natural fertility. More importantly, it is found that the influence of landholding is sustained, though at a lower level (beta = .22). In other words, part of the effect of landholding on fertility is due to concomitant variation of the fertility variable with one or more of the other variables in the model -- notably the husbands' age (and the wife's age) since they are closely linked to both fertility and landholding.

In summary, these findings confirm the main study hypothesis that landholding has a positive association with fertility in Rwanda, which further confirms the land-labor-demand hypothesis. Thus this study supports the economic model of fertility originally presented by Becker (1960, 1965) and further elaborated by various other social scientists including Clay and Johnson (1990), Easterline (1976), and Schutjer and Stokes (1980, 1983). On the other hand, this study does not support the land-security hypothesis presented by Schutjer and Stokes (1984, 1986) and other social scientists. Thus, it is confirmed that in

agrarian societies such as Rwanda, fertility is higher for those households that have more land. The only plausible explanation for this higher fertility is that couples tend to increase their fertility to meet the higher demand for labor which is economically and socially a rational decision.

Another significant finding is the disappearance of the negative effect of wife's education on fertility. This finding negates my earlier assumptions and studies reported by Caldwell (1980), Courbage (1984), Jain (1981), and Sathar (1984) which emphasize literacy and education as forces lowering fertility. One is led to suspect that education, in the absence of other socio-economic changes in Rwanda, is not able to bring down fertility.

SECTION 2

LAND OWNERSHIP AND FERTILITY

In reviewing of the literature, I have presented a detailed discussion of the land-labor and land-security hypotheses. It was suggested that landholding increases the demand for children, which in turn leads to higher fertility. On the other hand, ownership of land provides old-age security to parents since the equity income derived from landholding substitutes for the security provided by the children. As a result, parents tend to have fewer children. This hypothesis suggests that: if couples operate rented land, they will have more children to meet the demand for labor; but if they own land, they will still have a demand for labor, and more children to meet this demand, yet there will be a negative influence on fertility as well, since the need for old-age security (as provided by children) will be lower.

As mentioned earlier, almost every rural household in Rwanda owns at least some land. According to the statistics provided by the Ministry of Agriculture (SESA, 1986) 99% of rural Rwandans own some land. About 51% farmers operate only their own land. The remaining 48% operate their own, and also rent in land as well. Therefore, the sample is divided into two sub-groups: 1) Those who both own land and

rent in additional land, and 2) those who operate their own land only. I expect to find that both groups will demonstrate a positive association between farm size and fertility as a consequence of labor-demand hypothesis. We also expect to find that this positive relationship between landholding and fertility will be weaker for owners, when compared to owner-renters, as consistent with land-security hypothesis. Since the average size of operational landholdings is nearly the same for owners and owner renters (2.7 vs 2.2 ha), I expect that the effect of the landholding variable will be largely a reflection of the different forms of tenure.

Table 12 compares the mean number of children for owners and owner-renters across categories of the key independent study variables. In the aggregate, those who own all of their land and those who rent a portion of it have very similar fertility patterns, as the mean number of children for these groups is 5.0 and 4.8 respectively. An increase in landholdings for both groups leads to an increase in the number of children couples have. The average number of children for owner-renters is 3.8 for those who operate less than .5 ha of land, while this average is increased to 5.9 for those who own/rent 2.0 ha or more of land. Similarly, average number of children increases from 3.33 to 5.87 for those who own only. These figures suggest that there is not a significant difference in the fertility

behavior of both the groups. I further examined the effects of landownership through the comparison of means of the two groups using a one way analysis of variance. The aggregate measures of association show little difference in the farm size-fertility relationship (eta = .36 versus .33). In other words data do not support the hypothesis that landownership can substitute for children in the provision of old-age security. When compared across categories of the other independent variables, the effect of land tenure similarly contributes little to the understanding of why some Rwandan couples have more children than do others.

When brought together in a multivariate regression (Table 13), controlling simultaneously on the broader array of independent variables, the land tenure effect again brings little to the analysis. Those with more land tend to have more children regardless of whether they own it or rent it. Moreover, age of wife, age of husband, and temporary migration are other variables that show a common positive association with fertility for both groups; education of wife and wife's age at marriage have a negative relationship with fertility for both groups; the remaining two variables, female participation in labor force and husband's education, are, again, unrelated to fertility for both groups.

In summary, the overarching conclusion to be drawn from this analysis is that the positive effect of landholding on fertility is sustained for both groups roughly in the same

Table 12. Number of Children by Other Variables in the Model, Owner/Renters and Owners only Couples.

Variables	MEAN NUMBER OF CHILDREN OWNER/ RENTERS	(N=)	OWNERS ONLY	(N=)
Landholding				
.5 ha - less	3.83	92	3.33	64
.5 ha - 1.00	4.36	118	4.76	121
1.0 ha - 2.00	5.92	88	5.30	115
2.0 ha - above	5.93	29	5.87	119
Total	4.77	327	5.01	419
Eta	.36		.33	
Sign.	.00		.00	
Wife's Age				
18 - 29	3.07	107	2.99	119
30 - 39	5.50	161	5.77	212
40 - 49	5.88	59	5.90	88
Total	4.77	327	5.01	419
Eta	.49		.50	
Sign.	.00		.00	
Wife's Age at Marriage				
14 - 17	5.19	79	5.51	97
18 - 20	4.88	153	5.23	187
21 - 38	4.40	86	4.44	112
Total	4.83	318	5.01	396
Eta	.12		= .17	
Sign.	.10		= .00	
Wife's Education				
No Schooling	5.06	216	5.17	284
Incomplete Primary	4.29	87	4.97	101
Primary	3.83	24	3.87	31
Total	4.77	327	5.02	416
Eta	.18		.13	
Sign.	.00		.02	

Continued on next page....

	(Owner-Renters)		(Owners)	
	Mean Number of Children	(N=)	Mean Number of Children	(N=)
Husband's Education				
No Schooling	4.95	152	5.06	191
Incomplete Primary	4.53	133	4.92	148
Primary and above	4.86	42	5.14	77
Total	4.77	327	5.02	416
Eta	.08		.03	
Sign.	.33		.79	
Husband's Age				
< - 30	2.64	59	2.56	54
31 - 50	4.94	179	5.16	211
51 - >	5.82	89	5.67	154
Total	4.77	327	5.01	419
Eta	.44		.39	
Sign.	.00		.00	
Migration Days of Husband				
0	4.83	132	4.99	188
1 - 180	4.26	80	4.48	75
181 - 730	4.78	51	4.87	68
731 - 9490	5.25	64	5.59	88
Total	4.77	327	5.01	419
Eta	.14		.14	
Sign.	.11		.04	
Female Labor Force Participation				
0	4.83	158	4.82	217
1 - 120	4.76	111	5.43	94
121 - 360	4.62	58	55.02	108
Total	4.77	327	5.01	419
Eta	.04		.10	
Sign.	.86		.15	

Table 13. Zero Order (r) and Partial (beta) Correlations Between Independent Variables and Fertility (Number of Children) for two groups.

	Fertility of Renters/Owners		Fertility of Owners Only	
Independent Variables	**(r)**	**(Beta)**	**(r)**	**(Beta)**
Education of Wife	-.16*	-.04	-.12	-.01
Wife's Age at Marriage	-.11*	-.15*	-.22	-.26*
Wife's Labor Force Partic.	-.05	.03	.02	.06
Migration Days	.16*	.05	.07	.02
Age of Wife	.46*	.37*	.38	.40*
Age of Husband	.41*	.05	.28	-.04
Education of Husband	.01	.06	.04	.07
Landholding	.33*	.18*	.32	.26*
R Square		.28		.26
(N=)	(318)			(396)
Significance	-.01			-.01

order of magnitude. Since landholding has a positive effect on fertility for both groups, it can be concluded that the land-labor demand hypothesis holds up in Rwanda regardless of whether farmers own all of their operational holdings or not. The hypothesis that landownership would weaken the farm size-fertility association has not been supported.

Broadly speaking then, the data reviewed in this section suggest that fertility in rural Rwanda is largely determined by the economic utility of a large family work force. Economic utility may be especially important in this subsistence economy where the use of modern agricultural technology is limited and where most agricultural tasks are highly labor intensive. This demand for family labor is met through higher fertility.

As for the land security hypothesis, it seems to have little applicability in Rwanda. Plausible explanations for this finding could be that: 1) Average farm size is very small (1.2 ha) and this could not provide adequate maintenance for elderly couples if rented out 2) Cultural traditions in Rwanda obliges parents to transfer landholdings to their children (regardless of how many they are) as the children marry and have children of their own, and 3) Rwandan children are expected to care for their aging parents regardless of how much land the parents own or other forms of wealth they manage to accumulate (Clay and Vander Haar, 1990).

SECTION 3

FERTILITY, POPULATION GROWTH, AND PLANS FOR THE FUTURE

The demographic literature suggests that, in general, fertility in any society is a reflection of desired number of children by parents in that society (McClelland, 1983). The desire for children, on the other hand, often varies with the socio-economic conditions of households and populations as a whole. In an agrarian society where family labor is highly valued, desired family size is usually quite high. By contrast, the desire for larger families diminishes as societies become less dependent on family labor and where inter-generational wealth flows are such that children become a liability to parents (Caldwell, 1981). This section examines some of the preferences and opinions of Rwandan couples and of their adult children regarding childbearing, population growth and their future in agriculture. In particular the focus is on the following questions: 1) How do husbands and wives in Rwanda perceive the problem of rapid population growth? 2) What are their perceptions regarding the consequences of rapid population growth, notably a decline in average landholding? 3) What perceptions do their children hold about their own fertility? 4) Do these children see high fertility as a problem? 5) Do fertility-related

perceptions and opinions vary from one generation to the next?

Table 14 reports that in response to the question,

Table 14. Opinions of Husbands, Wives, and Children on Land Inheritance.

Sufficient Land For Family/ Children Use	Husband (%)	Wife (%)	Sons (%)	Daughters (%)
Enough Land	17.4	18.8	14.5	14.7
Not Enough Land	80.1	76.0	80.9	81.9
Other	2.5	5.2	4.6	3.4
Total	100.0	100.0	100.0	100.0
(N=)	(667)	(680)	(220)	(232)

"Do you think you have, or have had in the past, enough land for inheritance needs of your children?" an overwhelming majority of husbands and wives (80.1%, 76.0%) responded negatively. Both the sons and the daughters (80.9%, 81.9%) of these couples confirm this finding by showing their dissatisfaction over the lack of available land in response to the question, "Do you think you will have enough land for your own family's needs?". Table 15 suggests that the opinions of husbands regarding the shortage of land is

supported by an overwhelming majority of wives (94.1%) and sons (91.5%).

Table 16 itemizes some of the problems reported by the parents as a result of overpopulation. An overwhelming majority of the respondents (96.3%) believe that population growth is fast and that it is creating special difficulties for themselves and for their children. Insufficient land was the most serious problem reported by both husbands and wives; food shortage was the next most important problem reported. However, there are 20% of the women and 16% of the men who do not perceive overpopulation to be a problem at all. Both husbands and wives agreed that the situation will be even worse for their children. As reported in Table 17, this danger is felt by both husbands, wives and their children regardless of the amount of land they own.

When asked about possible strategies for coping with the problem of land shortage, both parents and children gave wide variety of answers. These responses are reported in Table 18.

Limiting fertility in order to overcome the land shortage problem was one of the possible strategies in the structured responses in the questionnaire. Despite the fact that an overwhelming majority (96.3%) of the respondents mentioned earlier that over-population was a serious problem, family planning programs do not seem to be popular among

Table 15 Opinions of Wives, Sons and Husbands (Fathers) on Land Inheritance.

	HUSBANDS	
	Enough	**Not Enough**
Wives		
Enough Land	48.5	5.9
Not Enough Land	51.5	94.1
Total	100.0%	100.0%
(N=)	(66)	(203)
Sign ≤.001		
Gamma .87		
Sons		
Enough Land	45.5	8.5
Not Enough Land	54.5	91.5
Total	100.0%	100.0%
(N=)	(22)	(106)
Sign ≤.001		
Gamma .80		

Table 16. Problems Reported for Themselves and Their Children by Those Parents who Believe that Population Growth is Fast.

	Husbands (%)	Wives (%)
Population Growth is Fast		
Yes	96.3	96.7
No	3.7	3.3
Total	100.0	100.0
(N=)	(656)	(636)
Problems For Self		
Insufficient Land	61.3	54.4
Food Shortage	21.0	22.4
No Problem	15.6	20.3
Other misc. Problems	2.0	2.9
Total	100.0	100.0
(N=)	(633)	(616)
Problems For Children		
Insufficient Land	66.8	60.5
Food Shortage	22.5	23.0
No Problem	6.0	10.9
Other Misc. Problems	4.7	5.7
Total	100.0	100.0
(N=)	(632)	(617)

Table 17. Percent of Husbands, Wives, Sons, and Daughters who State that the Available Land is Insufficient for Their Families Needs, by Farm size.

Farm Size	Husbands (%)	Wives (%)	Sons (%)	Daughters (%)
0 -.5 ha	100	100	100	100
.5-1.0 ha	88	82	89	87
1.0-2.0 ha	86	80	79	83
2.0- ha	70	68	81	87
(N=)	(244)	(231)	(120)	(137)
Chi Square	15.3	10.2	2.5	2.3
Sign.	.00	.01	.48	.51

Rwandan couples. Thus, birth control as a remedy to overcomet he problem of land shortage was not a very popular response. This finding is consistent with reports from other countries of Africa where very extensive and intensive efforts to introduce modern contraceptives through family planning programs have not succeeded (World Bank, 1986). World fertility survey data support this claim by reporting that the majority of African married women in the age group of 15-49 do not use contraceptives. At the time of survey only 1% of women in Mauritania, 2% in Cameroon, 3% in Ivory Coast, 4% in Senegal, 5% in Lesotho, 7% in Kenya, and 9% in

Table 18. Strategies of Parents and Children who Believe They Will Not Inherit Enough Land for Their Families' Needs.

Strategies Reported by Parents and Children	Husband (%)	Wife (%)	Sons (%)	Daughters (%)
Migrate for Work	8.1	10.2	5.9	8.7
Agricultural Labor	5.4	6.3	22.7	10.5
Non-Agric Training	23.3	15.4	18.4	16.3
Limit Births	5.0	7.5	10.8	37.2
Will Manage Somehow	21.5	27.9	- -	- -
Buy/Rent in More Land	19.8	20.6	- -	- -
Other	16.9	12.1	42.2	27.3
Total	100.0	100.0	100.0	100.0
(N=)	(516)	(480)	(185)	(172)

Benin were using some method (United Nations, 1987). An overwhelming majority of these current users, however, were using only traditional and non- supplied methods.

Although the favorable responses for birth control are very few, the variations in responses by gender and generation are quite significant. Birth control is the least popular strategy among husbands and wives. Only about 5-6% of all husbands and wives reported that they would limit their number of children to overcome the problem of insufficient landholdings. Birth control was also rather

unpopular among sons as only 10.8% reported that they intended to limit their childbearing. However, for 37.2% of the daughters in the sample, this was the most important response of all. This change among the young women of the new generation is most probably a result of higher literacy and education rates. Moreover, the younger generation is exposed to the mass media, which carries family planning messages targeted towards them, particularly towards young women.

The possibility of migrating to other areas in search of work does not seem to be very popular strategy among either of the two generations. Rwandans have strong ties with their families and local communities and do not see migration as a viable strategy. Moreover, the low literacy rate in Rwanda makes it very difficult for rural youth to compete for non-farm jobs. And, given a weak industrial sector there are very few alternative employment opportunities (Clay et al., 1989). Despite this difficult situation, one of the more frequently cited strategies reported by husbands (23.3%), wives (15.4%), sons (18.4%), and daughters (16.3%) alike was to seek out non-farm employment locally. A less desirable option for most is to provide agricultural labor to those farmers possessing greater resource endowment. This is especially unpopular among parents, though the younger generation, particularly sons, indicated a willingness to sell their labor.

Another important strategy reported by approximately 20% of the parents was that children should rent in or buy more land to overcome the shortage. The remaining responses given both by parents and children have been grouped together but include the following: 1) It is government's responsibility to take care of this problem, 2) Will join a cooperative, 3) Will start a business (a micro enterprise), 4) Conservation of soil, and 5) Other miscellaneous responses. One last response given by 21.5% of the men and 27.9% of the women was that their children will somehow have to manage to deal with the problem on their own, with little help from their families.

In summary, it can be concluded that there is: 1) A clear difference in the attitudes of parents and their children regarding fertility regulation as a solution to the problem of limited land resources and a growing population, 2) A willingness to work in the non-farm sector, and 3) A continuing aspiration that land will be available through rent or purchase. That attitudes toward family size are changing is a significant finding. It appears that although the Rwandan family planning program has seen only limited success over the past decade, messages from the National Population Office (ONAPO) are at least heard by the younger generation, especially young women. A higher literacy rate among children as compared to their parents, frequent exposure to the mass media, growing urban influence, and an

expanding family planning campaign all contribute to this change in thinking. Clearly, the success of family planning in Rwanda will depend on the campaign's ability to target and win over the younger generation of parents. The second most popular strategy by parents and children rests upon the abilities of young people to secure employment in the non-farm sector. Yet under present conditions, it is very unlikely that the non-farm sector will be able to absorb more than a small fraction of the young people entering the work force each year. The aspirations of young people to work in the non-farm sector will continue to drive them in large numbers to Kigali and some of the secondary urban centers. Insufficient housing and sanitation, unemployment, crime, congestion, and other urban problems will likewise continue to grow. And for those who intend to buy or rent more land, the prospects are equally poor since even the Eastern region of Kibungo is now "closed off" to newcomers. However, one can surmise that population growth in the future will increase the demand for land, raising its price and lowering the standard of living for those in rural households unable to acquire additional landholdings. Though reduced fertility is the only long-term solution, development of the non-farm sector, which is being warmly welcomed by the younger generation, must occur in the near term.

Opinions on the desired, ideal, and recommended number of children have for decades proved to be a most

controversial subject in the demographic literature (Rider and Westoff, 1965). Methodological problems have been particularly acute in developing countries where the majority of the rural population struggles to meet their daily subsistence needs. All too often these couples are not in a position to plan for their future, due in large part to uncertainties in socio-economic conditions. In addition, family planning programs in most developing countries are partially or fully funded by the international donor agencies and the renewal of these funds almost always depends upon the demonstration of achievement (Chambers, 1983). The easiest way to show goal achievement is by providing figures on so-called changing attitudes toward fertility, which are argued to forecast actual fertility decline. Hence, data on fertility attitudes and opinions from developing countries are often inflated.

Table 19 reports the mean desired fertility as stated by Rwandan parents and the number of children they recommend for their own sons and daughters. In addition, the table reports the desired fertility of the adult children themselves. In response to the question, "How many children do you want to have?", the mean number of children reported by husbands and wives is 5.3 and 7.3. These numbers are very close to the desired fertility reported by couples in other African countries such as Ghana (6.0), Lesotho (6.0), Sudan (6.4), Kenya (7.2), Benin (7.6), Senegal (8.3), Ivory Coast

Table 19. Desired and Recommended Number of Children by Parents, and Desired Fertility by Their Children.

Number of Children	Mean Desired	Mean Recommended
Husband	5.34	6.14
Wife	7.31	5.70
Children	4.23	- -

(8.4), and Mauritania (8.8) (United Nations, 1987). When asked, "How many children do you recommend that your sons and daughters have?", husbands and wives reported 6.1 and 5.7 children. Adult children in the family reported that on average they would like to have 4.2 children.

The following general conclusions can be drawn from the data presented in Table 19: 1) Both husbands and wives in Rwanda maintain very high fertility preferences, 2) Both parents recommend high fertility to the next generation, 3) Husbands recommend more children to the next generation than they desire to have themselves, 4) Wives recommend fewer children to the next generation than they desire to have themselves, 5) Adult Children, however, intend to have fewer children than their parents either desire or recommend.

Overall, then, a significant difference can be observed in the attitude of children as compared to their

parents. This changing attitude might be attributed to various socio-cultural factors including: schooling, exposure to different socio-cultural conditions, knowledge of family planning programs, and the diffusion of non-traditional ideas.

In summary, these findings suggest that an overwhelming majority of the respondents are aware of the fact that there is not enough land for parents and even less for the families of their children. Only a small proportion of parents still believe that they can rent in land to overcome a lack of land ownership. The remaining children and parents report a variety of other strategies to cope with the problem of limited land availability.

The vast majority of parents also report that they realize that the population of Rwanda is growing rapidly. They likewise recognize that land scarcity and food shortage is a result of this rapid population growth. Although parents are aware of these problems, they nonetheless demonstrate a desired family of six children on average. By contrast, the average desired number of children reported by the younger generation is much lower than that of the parents.

Rwanda's policy makers should be very cognizant of this troublesome situation and take into account in future planning. Unless economic circumstances change dramatically, it appears that current high fertility rates and a very great

desire for children will persist in the near future. As a result, the population of Rwanda will continue to grow at a very high rate well into the next century.

CHAPTER 7

CONCLUSION

Summary

Rapid world population growth has been the subject of considerable discussion for decades and has led to multiple perspectives regarding its fundamental issues and consequences. However, most social scientists agree that the fertility behavior of individuals in any society is influenced by a broad range of social forces often referred to as the structural determinants of fertility, and is significantly different for rural and urban populations. Since an overwhelming majority of rural populations everywhere are engaged in agricultural production, it stands to reason that the underlying structure of agricultural systems will be among the more important determinants of social behavior, including fertility. Previous research has argued that among other things, the size of landholdings significantly influences fertility. The literature further suggests that there are two schools of thought on the direction of the landholding-fertility relationship. First, advocates of the Land-Labor Demand Hypothesis argue that an increase in land under operation leads to a higher demand for labor. Among married couples, the response to this higher

demand for labor is higher fertility (Ajami, 1969; Aghajanian, 1978; Hawley, 1955; Schutjer et al., 1980 and 1983). Second, those who support the Land-Security Hypothesis assert that land under operation may be of two types: 1) land owned and operated by the family, and 2) land operated by the family but not owned. They posit that landownership is a substitute for children and that it provides parents with social security in their old age. As a result, fertility among owners of land tends to be lower than among those who are renters (Chalamwong et al., 1979; Good et al., 1980; Hiday, 1978; Schutjer et al., 1980; Vlassoff and Vlassoff, 1980). To test and evaluate these contradictory views of fertility behavior of rural farm populations is the aim of this study. The area selected for study is Rwanda, one of the world's fastest growing populations, and one heavily dependent upon subsistence agriculture.

Rwanda is a small, developing country situated in the East African highlands. The majority of Rwanda's population is comprised of Hutus, Tutsis, and Twas, three ethnic groups that migrated from other parts of Africa and now occupy virtually all of Rwanda's rural areas. Geographically, the country has limited natural resources; farmland has become very scarce over the past decade. Agriculture is the backbone of the economy of Rwanda and despite very dramatic changes in agriculture in other parts

of the world, centuries-old hoe agriculture is still practiced in Rwanda. The industrial sector is almost non-existent, which forces the government to import millions of dollars of industrial goods each year. The overall picture of the economy of this country, as indicated by the GNP per capita of $300, is very bleak. Population growth, at the same time, has accelerated from 2.6% to 3.4% over the past fifteen years. In fact, the total fertility rate of Rwanda now stands at 8.3 births per woman, the highest in the world. This rapid population growth is disturbing the ecological balance of this country by putting extreme pressure on already limited natural resources.

To better understand the accelerated growth of population in Rwanda, various studies have been conducted by both national and international agencies. The data for this study derive from a nationwide survey of non-farm strategies, a survey conducted by the Government of Rwanda and USAID in 1988. Questions on fertility, on-farm and off-farm employment, permanent and temporary migration, plans and opinions regarding landholding, family size, non-farm training and employment, and the future for young people in farming were asked of the heads of the 1,019 sampled households.

Using data from this survey, the present study has tried to answer the following questions: 1) What is the relationship between landholding and fertility? 2) What is

the validity of the land-labor and land-security hypotheses? and 3) How are the fertility opinions of parents and adult children shaped in this rural society?. It was argued that wife's age, education, age at marriage, and participation in labor force; husband's age, education, and temporary migration for work; and landholding of the household would have both direct and indirect influences on fertility. To answer these questions the analytic approach was divided into three sections. A conceptual model (depicted in Figure 5 of chapter Four) was constructed to partial out the direct and indirect effects of the key study variables. In the second section, the sample was divided into two sub-samples, namely, those who own and operate all their land and those who own and operate some of their land but also rent land from their neighbors. As argued in the land-security hypothesis, it was assumed that the fertility of those who operate only their own land would be lower than for those who own and rent. In the third section, the fertility-related opinions of parents and children were explored.

The initial descriptive analysis tells that the population of Rwanda is characterized by small landholdings, high fertility, very low levels of schooling, an early age at marriage, very little participation of women in non-farm activities, and significant migration of men for work. These characteristics can be observed in many of the developing nations of Africa and Asia today. Landholding in Rwanda,

however, is different from many developing countries in the following ways: 1) almost every farmer owns at least some land, a characteristic not shared by developing nations such as Bangladesh, India, Pakistan, and Sri-Lanka where there is a very large number of landless farmers; 2) average landholding in Rwanda is 1.2 ha, which is very little when compared to many other agrarian societies; 3) the range of landholding is .03 ha to 14.2 ha which is again well below many other nations. The range in Pakistan, for example, is from no land to thousands of hectares of land per household; 4) unlike other developing nations where the mechanization of agriculture is taking place, Rwandan farmers still rely on hoes and other hand implements, requiring a continuous demand for agricultural labor. These characteristics of the agricultural system in Rwanda, therefore, make this country an excellent area to test the land-labor and land-security hypotheses.

On the basis of the analysis of the sample, it can be concluded that although variation in landholding is small relative to many Third-World countries, it has a significant effect on childbearing. The data show that an increase in landholding from 0.5 ha to 2.0 ha leads to an increase in fertility from 3.62 to 5.88 children, or more than two children per household. To partial out the indirect effects of other variables, zero-order correlations and betas were calculated. The relationship between fertility and

landholding is confirmed by a significant zero-order correlation of 0.31. This positive relationship was further confirmed by a multivariate regression analysis which yielded a significant correlation of .22, once other variables in the model were controlled.

Comparison of the means of other variables in the conceptual model for the sample suggest that: 1) age of husband and wife, and the number of days husbands were absent due to temporary migration tend to have a positive effect on fertility; 2) wife's age at marriage and her level of education exert a negative effect on fertility; and 3) husband's education and female labor force participation do not influence their fertility. Based on the results of a regression analysis including these variables, it can be observed that: 1) age of wife sustains its positive relation with fertility, 2) wife's age at marriage sustains its negative effect on fertility, 3) wife's participation in labor force and education of husband remain un-related to fertility, and 4) the positive effect of age of husband and his migration history, as well as the negative effect of education of wife on fertility, disappears.

To test the land-security hypothesis, the total sample was divided into two sub-groups. The first group is comprised of 419 households operating only their own land. The remaining 327 couples who mentioned that they operate their own as well as rented land were the second group. It

was hypothesized that as a result of the land-security effect, the fertility of owner-operators would be lower than the owner-renter group.

The data analysis for owners and owners-renters suggests that: 1) an increase in landholding for both groups leads to an increase in number of living children; 2) effects of all other independent variables on the fertility of the two groups is not significantly different; and 3) the average fertility for owners and owners-renters is not much different. In fact, it is even slightly higher for owners. Multiple regression on the same set of variables for both groups shows identical influences on fertility. Zero-order correlations (.33, .32) and betas (.18, .26) between landholding and fertility for owners-renters and owners suggest that the fertility of these two groups is equally influenced by landholding. This conclusion negates the land-security hypothesis and confirms the land-labor demand hypothesis. In fact, since the average number of living children for the couples who operate only their own land is higher than for owner-renters, the hypothesis that old-age security provided by land ownership tends to suppress fertility is rejected. It is quite possible that this difference is a result of higher survival rates for children of owners, since they are economically better off than renters.

The third section of the analysis deals with the opinions of parents and their adult children. Following conclusions are drawn from this section: 1) on average, parents in Rwanda desire more than 6 children; 2) they recommend a little less than six children for the next generation; 3) husbands recommend more children for the next generation than do the wives; 4) contrary to the desired and recommended number of children stated by parents, adult children intend to have lower fertility.

Conclusions

This study has addressed a number of important questions raised in the demographic literature. Previous studies on the relationship between landholding and fertility posed several empirical and conceptual problems which I have tried to deal with here (Stokes and Schutjer, 1984). Empirically, the focus of most of these studies was not on the relationship between landholding and fertility, but rather land was used as an indicator of socio-economic status. Moreover, the compounding effects of other exogenous variables was usually ignored. I also note that no consideration was given to the reverse hypothesis, which suggests that a positive relationship between landholding and fertility is due to the fact that parents adjust their

landholding in accordance with the number of children they have.

In this study it was tried to overcome all these problems by: 1) providing an empirical test on the relationship between landholding and fertility at the household level; 2) using multiple regression analysis to partial out the effects of other exogenous variables on fertility; and 3) bringing to bear results from another study using the same data (Clay and Johnson, 1990) on the reverse hypothesis, in order to refute the hypothesis of a reverse effect of fertility on landholding in Rwanda.

The major conclusion is that the data support the land-labor demand hypothesis previously tested in other regions. The land-security hypothesis does not seem to hold up in Rwanda. Other findings based on respondents' opinions indicate that although parents in Rwanda have high fertility for themselves, they recommend even higher fertility for their children. Yet, the younger generation seems to be influenced by new demands of time and a desire to have fewer children. They are inclined to use contraceptives to control their fertility and to control rapid population growth. Girls, as compared to both boys and their parents, indicate a more positive attitude toward family planning programs.

In addition, these data lead to a number of other interesting conclusions regarding the remaining six variables (wife's age at marriage, wife's participation in the labor

force, wife's education, husband's migration for work, husband's education, and husband's age).

The literature drawn from many regions of the world contains many examples of where wife's age at marriage exerts a negative effect on her fertility (Smith, 1983; Udry, 1982); this data too support this conclusion. As is the case in other developing countries, age at marriage in Rwanda is determined by various local socio-economic conditions. The primary role of women in Rwanda is to bear and rear children. Level of schooling for women is very low, and parents encourage their daughters to marry as early as possible. Moreover, most men in developing countries want to marry younger women, resulting in very little "demand" for women above age 25. Hence, age at marriage for women in Rwanda is as early as 14 years.

The demographic literature further suggests that the labor force participation of women lowers their fertility by changing the priorities of working women and making child-bearing and child-rearing an expensive practice (Courbage, 1984; Freshnock and Cutright, 1978; Happel et al., 1984; Jones, 1981). The data indicate that labor force participation in Rwanda does not have the same effect. This may be explained by three factors.

First, most studies on the labor force participation of women use data on women's participation in the industrial urban sector. The industrial urban sector

exposes women to an entirely new world, including a different work ethic, scheduled working hours, new and better communication channels including newspapers, radio, television, new friends with different peer pressures, and western ideas. In general, this exposure broadens her views on fertility. In this new world of competition, children become a liability and a hinderance to upward social mobility. In addition, work gives a woman economic power and better status in the household. All of these social changes give her new decision-making powers, including the decision as to how many children she should have. Women in Rwanda, on the other hand, tend to work on nearby farms or in cottage industries. In most cases they continue to live in their homes with their families or move to a nearby place. Even her earnings are pooled with the family budget and give her little economic freedom. Such labor force participation does not expose her to the kinds of social changes described above, changes which are necessary to transform attitudes towards fertility. Hence, fertility for women in the labor force remains high in Rwanda.

Second, raising children in Rwanda is neither expensive nor a major hinderance for working women because children are usually raised by the entire family. Brothers, sisters, and older members of the family are called upon to help out with child care. A working woman, therefore does not necessarily have to give up such work in order to care

for her children. Moreover, the work ethic in most African countries is very different from that of the western world. Bringing children to work in an industry in a western country is almost un-thinkable. In contrast it is quite common in Africa to bring an infant to work, particularly in cottage industries and other jobs demanding physical labor. Hence, it can be inferred that higher fertility in Rwanda is not a barrier to work for women because this society has adopted various alternatives to cope with the possible difficulties during work as result of the birth of a child.

Third, as discussed earlier, Rwanda still has a high demand for labor which suggests that it is the quantity and not the quality of children that is important. More children in a family means more hands. These children start helping their parents at a very early age and quickly become an economic asset, not a liability to the family.

It is important to point out that although I have argued that the participation of women in the labor force does not have any effect on fertility in Rwanda, there is no evidence to negate the possibility of a negative relationship between female labor force participation and fertility in Kigali, Rwanda's one urban, industrial center. It is quite possible that participation of women in the industrial labor force in Rwanda will bring negative effects on fertility similar to those observed in other parts of the world.

There is much literature from all over the world that suggests that education of the wife bears a negative effect on fertility (Casterline, 1985; Pol, 1983; Sathar, 1984). This data reveal similar results for Rwanda at the bivariate level. However, the negative influence of wife's education on fertility disappears as other variables are controlled. These results suggest that although the direction of the relationship between education of wife and fertility in Rwanda is negative, it occurs in the presence of other variables. Some possible explanations for this phenomenon may be the following:

First, only 7.4% of all wives in Rwanda reported primary and higher levels of schooling, which might have lowered the overall effect of this variable on the entire sample.

Second, introduction of western education in most developing nations exposes young people to new ideas which dominate traditional knowledge and belief systems. Such education brings reasoning, rationality, and logical thinking with it. Moreover, it strengthens the economic power of educated people, particularly of women, through new job opportunities. They not only make decisions for themselves but in many cases for the entire household on almost all matters of daily life.

The educated family members become much more important in the households in countries like Rwanda where

parents are illiterate. They can make their own decisions and can deviate from the traditional wisdom which rests upon age and experience. Most probably Rwanda has not yet experienced these dramatic changes. Knowledge is still very traditional and the dominant belief system is equally traditional. Accordingly, it is believed that parents are supposed to have many children, bringing prosperity to the family. These beliefs are further supported by the existing religions and customs in Rwanda, all of which encourage higher fertility. Parents and other older members of the family are still considered to be a source of wisdom and guidance. These beliefs are reflected in school curricula, and text books, and are delivered in the classroom by teachers. Education, therefore brings little social change in Rwanda which is necessary to lower fertility.

Third, schooling opens doors to new job markets located in the urban areas in most developing nations which exposes educated people to different socio-economic conditions, new communication channels, new thoughts and ideas, and above all the new demands of city life. Demands such as the cost of housing, food, clothing, transportation, entertainment, medical bills, and the education of children, make them rethink the number of children they can support. They begin to consider the quality rather than quantity of children.

Since Rwanda has only just begun to make improvements in literacy and education, and has almost no industrial-urban sector, the majority of its population, including those who have achieved some education, remain tied to the rural setting and keep their emotional bond with their traditions.

Fourth, breastfeeding and longer postpartum sexual abstinence have been the norm in Africa, long considered "traditional contraceptives". These practices in Africa in the past have kept some control on fertility. Educated women in sub-Saharan Africa tend to deviate from these norms and this deviation has actually increased the fertility of educated women in some sub-Saharan countries. However, as time passes, these educated women are influenced by the new socio-economic conditions of urban life and tend to improve the health care and survivorship of the children they do have, instead of having as many as they possibly can. Since educated women in general are better informed of family planning methods, they tend to use these methods in response to a change in attitude. This argument suggests that educated women, regardless of the fact that they have higher fertility initially, eventually lower their fertility (Bongaarts et al., 1984). The main conclusion, which can be drawn from this discussion is that the mass education of women, which according to Caldwell (1980, 1988) produces a negative effect on fertility, even in the absence of other

socio-economic changes, does not appear to be operating in this country for the time being.

Mead Cain (1985) reported that temporary migration of the husband for work separates the spouses for long intervals and thus tends to lower fertility in Bangladesh. This data suggest that the temporary migration of husbands in Rwanda is un-related to fertility. Most probably these contradictory findings are a result of the very different socio-economic conditions of Bangladesh and Rwanda. There are four such differences that merit reiteration here.

First, Bangladesh in contrast to Rwanda has a very large urban industrial sector. Jute, textile, fish, rice, tea, textile, forestry, paper, and ready made garments are some of the industries which provide employment to the huge population of this country (Heitzman, 1989). It has over a dozen big cities with latest technology and infrastructure. In Rwanda, on the other hand, Kigali is the only metropolitan center, and even the industrial sector is quite underdeveloped. Hence, the urban sector in Bangladesh provides more pull factors to its rural population for temporary labor migration than does Rwanda.

Second, Bangladesh, in contrast to Rwanda, has a more developed communication system. As of 1986, there were about 10,890 kilometers of publicly maintained motorable roads, 2,818 kilometers of railroad tracks, and its airline linked 18 cities of Bangladesh within, and with 48 countries of the

world. There were 62 daily newspapers, 24 radio stations, and television with 12 relay stations covering almost all of Bangladesh (Heitzman, 1989). These communication channels link rural population of Bangladesh with other parts of the country and rest of the world, exposing inhabitants to other material and non-material cultures.

Third, Bangladesh, unlike Rwanda has been a family planning target of both national and international donor agencies for decades. The Family Planning Program was formally introduced in East Pakistan (Bangladesh) during the second five year development plan in 1960, and 6 million dollars were allocated for both East and West Pakistan (Government of Pakistan, 1980; Stamper, 1977). Matlab has been used as a research area for more than two decades for various surveys and experiments. Government expenses on family planning rose to 45.1 million dollars in 1980 and it is still increasing (Bulatao, 1984). All of these efforts have not only exposed the majority of the population of Bangladesh to family planning programs but also they have succeeded in raising the number of contraceptive users (Population Council, 1977). In contrast, the family planning program introduced in 1981 in Rwanda is still in its initial stages of development and the government has just recently begun to support the program financially. Hence, exposure to the family planning program, contraceptives, and their use is still not very common in Rwanda.

Fourth, temporary migration for work in Bangladesh has entirely different meanings from Rwanda. In Bangladesh it means working not only in local towns and cities but in the Middle East, and the Western countries, which keep the spouses apart for up to five years. On the other hand, temporary migration for work in Rwanda often means working in nearby villages and towns and keeping a frequent link with the household through weekly, biweekly or monthly visits. Because of these differences, migration days in Rwanda seems to have no effect on fertility in this country.

As in other regions of the world, education and age of husband appear un-related to fertility in Rwanda. Most probably other variables dominate the effect of education of husband and age of husband.

Policy Implications

Population structure and its dynamics are shaped by environments, technologies, and organizations and there is little doubt that population structure has a reciprocal influence on these variables. As noted from the literature, rapid population growth, and under-developed economy, limited technologies, and limited resources have brought about a disequilibrium among the components of the so-called "ecological complex" in Rwanda. In an effort to create a greater balance, it is argued that one or more of the components of the ecological complex must change. In the

following pages I will discuss some strategies for change and their policy implications, in the light of the conclusions.

Since landholding and agriculture are integral to the livelihood of most households in the Third World, the policy implications of these findings are very significant for agrarian societies in general and for Rwanda in particular.

Traditionally, an overwhelming majority of the population in most developing societies make their living from agriculture. In most of these countries the rural population has been divided into two classes. First, a minority population comprised of those who own large tracts of land, and secondly, a much larger number of small and/or landless farmers. The living conditions of both of these classes were are extremely disparate. Landless farmers and small farmers in developing societies have not enjoyed the same standard of living as their landlords. In spite of their hard work, often in very remote and depressed areas, they can not even afford the basic necessities of life such as food, shelter, drinking water, and medical care. These conditions lead to a higher infant mortality rate, lower life expectancy, lower literacy rates, lower enrollment in educational institutions, and slow economic growth for the country as a whole. Their landlords, on the other hand, comprised of an elite class who live relatively advantaged lives often in urban areas, enjoy every modern facility of

life, provide the best education to their children, and play significant role in politics.

Changing socio-political conditions in the world have forced many governments to introduce land reforms in order to distribute land more equitably among landless farmers and small landholders, with the hope of raising their standard of living. Keeping in view the findings of this study, it can be inferred that one of the factors of faster population growth in agrarian societies has been land reforms which have given property rights of land to farmers. Examples of such reforms come from India (Pike, 1985), Bangladesh (Lesser, 1989), Pakistan (Berki, 1980), and Sri-Lanka (Ross and Savad, 1988). The above references suggest that in most cases this land has come from un-used government land, waste land, land owned by tribes or villages, and excess land[4] owned by the large holders. In other words, it was land that was previously uncultivated, and that, in turn, raised the demand for labor and eventually fertility rates. In addition, improved economic conditions of farmers increased the survival rates of children, leading to higher number of living children at all ages. As a result of this higher fertility and limited land availability, the effects of land-redistribution have disappeared and another

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[4] Many countries have put a limit on the ceiling of landholding under these reforms. This limit, e.g, in pakistan is 1000 hectares of irrigated land and 1500 hundred hectares of non-irrigated land. This ceiling in Sri Lanka is twenty hectares of land per household

generation of landless farmers have appeared in these societies. Should these nations again introduce land reform and re-distribute land among landless and small farmers? Social scientists have contradictory views on this question.

Chaplin (1971), Rosenzweig and Evenson (1977), and Simon (1977) suggested that land redistribution would lead to increased fertility. However, Kocher (1973) and Rich (1973) argue that the initial increase in fertility as a result of land redistribution is temporary and that eventually fertility begins to decline as a result of better socio-economic conditions of farmers.

Since Rwanda is a unique agrarian society where, unlike many developing countries, every household owns some land and average holdings are very small, land reform may further increase fertility as a result of a higher labor demand. Yet since their is so little land available for redistribution, such reform would not likely bring about dramatic change in the living standards of farmers, therefore it would not lower fertility in any significant way.

Although land reform may indeed raise the living standards of Rwandan farmers, which in the long run may have some negative effects on fertility through higher schooling, survivorship, and acceptance of family planning programs, the government should be very careful in planning any such efforts for demographic reasons. An emphasis on land reform to achieve lower fertility is not a good strategy in Rwanda

because it cannot bring about dramatic changes in the lives of rural people, and its effects can only be temporary anyway, since the next generation will inherit still smaller parcels of land. Rather, land reforms should be accompanied by the development of the non-farm sector.

Schemes should be introduced to create growth in the rural non-farm job market. Development of non-farm sector will not only accommodate the surplus labor from rural areas but will also shift the population's dependency from agriculture to industry. Moreover, special efforts should be made to create a non-farm job opportunities for women because they play the primary role in bearing and rearing of children. Such job opportunities will change the woman's traditional role as a mother, and will in turn improve her status and decision making power on fertility-related matters.

The organizational component of the ecological complex is equally important in Rwanda and needs the serious attention of policy makers in this country. Unlike other developing countries, education in Rwanda seems to have little effect on fertility. Yet I still believe that the government should emphasize the achievement of higher literacy rates and mass education, particularly for women. As I have argued earlier, education eventually brings with it better economic conditions for the household, which in turn increases the survival rate of their children. Moreover,

educated couples tend to abandon traditional and natural methods of fertility control, such as breastfeeding and postpartum abstention, in favor of contraceptive use to control their fertility. Evidence the world over suggests that efforts to increase mass education in Rwanda will eventually lower the country's fertility. In addition, women should be given the right to own land. Any such reform will give women economic power and freedom, leading to greater decision making power. These changes will further give her freedom to use contraceptives if she so chooses. Moreover, the right to own land may also provide her some old-age security, and thereby lower her fertility as suggested by the proponents of the old-age security hypothesis. Finally, as suggested earlier, children in most developing countries are an economic asset to parents and they continue to support them as long as they live. The Government of Rwanda needs to begin thinking about creating alternative social security schemes which can replace security attached to children. The Government of China has successfully introduced such schemes as part of their rigorous family planning program in recent years, though whether such a scheme could be effective in a less coercive setting remains is a question for future debate.

In addition to the above mentioned efforts to bring about changes in environments, technology, and social organization, the policy makers should make serious efforts

to change the population factor, the fourth and last component of ecological complex, through family planning programs and reduce the current very high rate of population growth. In the combined presence of structural changes in society, a family planning program targeted towards the new generation, who has already reported their intentions to have fewer children, may very well be successful.

Rwanda joined the countries struggling to cope with their rapid population growth in 1981. The target of these programs is to create awareness, provide contraceptives, offer other family planning services, and conduct operations research on family planning. These efforts, however, have not yet had a dramatic effect, but rate of population growth in Rwanda has reached its peak and appears to be declining slowly.

Family planning programs in Rwanda are experiencing the same socio-cultural, religious, economic, medical, and administrative problems which similar programs faced in other developing countries. Although these programs have not yet succeeded entirely in many developing countries, they have begun to show their effects in less developed countries such as China, Costa Rica, Sri-Lanka, Kerala in India, Indonesia, and Malaysia. Most of these countries achieved their targets through: 1) mass education, 2) very well organized family planning programs based on the involvement of people and organizations at the grass roots level, 3) the introduction

of incentives such as tax rebates, plots in housing schemes, and free education for children for those who adopt family planning methods, 4) penalties such as fines, higher taxes, and higher tuition for students of those parents who do not adopt family planning programs, and 5) very realistic research reports on the achievements of these programs, followed by an improved program. The best of these efforts need to be modified for local socio-economic conditions and combined with changes in patterns of landholding, to achieve the goal of lower fertility in Rwanda.

Study Limitations and Suggestions For Further Research

Although this research explores the land-labor demand and land-security hypotheses in an African context for the first time, it raises many questions that merit further investigation. First, some of the more important limitations of this study should be taken into account. The principal dependent variable, fertility, defined as the number of living children born to the farm couple, does not account for infant mortality. It may be that the higher number of living children among those who have more land may be a result of more surviving children known as survival hypothesis in literature. Second, since every farmer in Rwanda owns some land, it therefore was not possible to isolate two entirely distinct groups, namely, those who just own and operate their land and those who operate other people's land, to compare

land-demand and land-security hypotheses. Third, some other variables, such as breastfeeding and infant mortality, were not included in this study, which may have helped to explain the impact of landholding on the number of living children.

Any effort to further explore the subject might need to overcome these limitations. In order to help clarify the larger extent of generalizability of this study it would be useful if it were replicated in other regions of Africa. And it would be especially important in future research that a socio-economic setting in which landlessness was present be included in order to better compare the land-labor and land-security hypotheses.

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