

95

03520

U·M·I
MICROFILMED 1994

INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

U·M·I

University Microfilms International
A Bell & Howell Information Company
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA
313/761-4700 800/521-0600



Order Number 9503520

Food crisis: Dilemmas in developing countries

Abdelrahman, Musa Shallal, Ph.D.

Iowa State University, 1994

U·M·I
300 N. Zeeb Rd.
Ann Arbor, MI 48106



Food crisis: Dilemmas in developing countries

by

Musa Shallal Abdelrahman

**A Dissertation Submitted to the
Graduate Faculty in Partial Fulfillment of the
Requirements for the Degree of
DOCTOR OF PHILOSOPHY**

**Department: Sociology
Major: Sociology**

Approved:

Signature was redacted for privacy.

In Charge of Major Work

Signature was redacted for privacy.

For the Major Department

Signature was redacted for privacy.

For the Graduate College

**Iowa State University
Ames, Iowa**

1994

TABLE OF CONTENTS

	Page
LIST OF TABLES	iii
I. INTRODUCTION	1
Statement of the Problem	3
II. THEORETICAL PERSPECTIVES AND LITERATURE REVIEW	7
Theoretical Perspectives	7
Modernization Theory	7
Dependency Theory	9
Literature Review	15
Theoretical Framework	28
Theoretical Hypotheses	31
III. DATA, METHODS, AND EMPIRICAL HYPOTHESES	39
Dependent Variables	40
Independent Variables	46
Problems of Validity and Reliability of the Data	58
Methods of Data Analysis	59
IV. FINDINGS	61
Contingency Tables	61
Zero Correlation Analysis	67
Multiple Regression Analysis	70
V. CONCLUSIONS AND RECOMMENDATIONS	75
Summary of Findings	75
Study Limitations	79
Conclusions and Recommendations	81
REFERENCES	86
ACKNOWLEDGEMENTS	96

LIST OF TABLES

	Page
Table 1. Calorie intake in developing countries, 1975 and 1985	41
Table 2. Descriptive statistics of the dependent variables	45
Table 3. Independent variables by developing countries	48
Table 4. Calorie intake by independent variables	62
Table 5. Calorie change by independent variables	65
Table 6. Correlations between calorie intake and independent variables	68
Table 7. Correlations between calorie change and independent variables	69
Table 8. Relationships between calorie intake and independent variables	72
Table 9. Relationships between calorie change and independent variables	73

I. INTRODUCTION

For more than two decades, food shortage has been the world's most important problem (Biswas and Biswas 1979). More than one billion people are chronically hungry every year. Thirteen to 18 million people die of hunger (Alamgir and Arora 1991). The problem is critical; food shortage has been described as the greatest and most brutal problem, the greatest challenge, a macro social problem, and a source of international concern (Wimberley 1991; Rau 1991; Cheng 1989; De Waal 1989; Grigg 1985; George 1984; Wells et al. 1983; Gunder Frank 1981; Presidential Commission on World Hunger 1980; Norse 1979; World Food Conference 1977; Hannah 1977; Lappe and Collins 1977; and Cereseto 1977). It has been looked at as a problem that may threaten the peace of the world by creating grave implications for all countries in the future.

Although food shortage has been known since the 19th century, it was not brought to the world's attention until the end of World War II. In explaining this, Grigg (1985) cited four reasons. One was the establishment of a number of mandated and voluntary organizations, such as specialized agencies of the United Nations that focus on the improvement of agriculture. A second reason is the number of records and publications about the problem. Third, universities all over the world have given the problem of hunger far more attention. Finally, discussion about causes and solutions of the problem has become controversial because of different ideological points of view and as a result attracted attention to them. Shortages of food existed in Europe before World War II. But after that war, most of the developing countries in Africa, Asia, and Latin America

also suffered. Within developing countries, Africa's situation is considered more desperate than those in Asia and Latin America (Paulino 1986).

The era after World War II includes the Green Revolution, especially the High-Yielding Varieties Program (HYVP) that enabled some countries to produce more food. However, the Green Revolution failed to stop famine and starvation and to feed the masses in many parts of India, where this policy was introduced in 1964. During the 1980s, malnutrition spread across the globe, even in the developed countries. It was estimated that in the late 1980s about 800 million or 15 percent of the people in the world fell short of the required nutrients (Meissner 1989). The failure of the Green Revolution in India was criticized for not considering social, political, and ecological elements, as well as for its techniques and technical requirements (Cereseto 1977). The increase in production in India mostly benefitted big farmers, merchants, and the rich, while the poor and smaller farmers lost (Chambers 1983). The HYVP requires a certain amount of water, fertilizer, and chemicals, which poor farmers cannot afford.

Developing countries in particular and the world in general not only face a dangerous temporary situation of food shortage but an acute future problem as well (Wharton 1977). The devastating aspect of this problem is increasing. Death rates are rising in at least 20 nations, most if not all classified as developing countries (Olembo 1977). The scope and magnitude of the problem of food shortages are growing. Scholars from many disciplines are searching for solutions to eradicate the roots of the problem. It is inhumane that at this time in history millions of people die every year all over the globe simply because they cannot find enough nutritious food to eat.

Statement of the Problem

The purpose of this study is to find out to what extent internal and external factors affected food shortages in developing countries in the period from 1975 through 1985. Food shortages threaten the world (Biswas and Biswas 1979). Many developing countries witnessed severe famines that took the lives of hundreds of thousands and left many more with permanent physical injuries between the years 1973-1974 and 1982-1984. Today, more than one billion people suffer from calorie deficits (Wimberley 1991). The U.N. Food and Agriculture Organization warned that developing countries will face again serious food shortages, especially in Africa during the 1990s (Rau 1991; De Wall 1989; Todaro 1989).

The relevant literature is rich with discussions of the impacts of the problem of food shortages which are considered devastating for people, the environment, development, and political and social process (Rau 1991). The majority of the labor force of developing countries is engaged in subsistence agriculture; they are the rural poor. Rural poverty, considered to be a principal cause of undernutrition and malnutrition, affects two-thirds of Africa, one-half of Asia, and about two-thirds of the population in Latin America (Grigg 1985; Pesqueira 1990). In these regions, effort to obtain food is a daily struggle. It is estimated that in developing countries the poor spend between 50 percent and 80 percent of their income on food and that half of all human deaths are in one way or another related to hunger (Mellor 1988; Kumar and Lipton 1988; Wells et al. 1983). Deficient diets lower resistance to infections, stunt physical and mental development of children, and reduce work capacity (Wimberley 1991). Food is essential

for human life; besides its importance as a physiological need, it serves as a social dimension reflecting social status, wealth, and customs (Mensah 1977).

Although there are other goals for development, food is becoming the most essential and has the highest priority on the development agenda (Cheng 1989). For Africa, food shortage is considered to be a symptom and a central cause of economic crisis in the last quarter of the century (Jennings and Street 1989). It has been predicted that (Presidential Commission on World Hunger 1980:IX) "...failure to assure adequate world food supplies would have graver and deeper implications for the international community in the years ahead than even current energy or inflation concerns." Vicker (1975) warned that if hunger and starvation prevail in developing countries, Americans may be affected directly by disease, inflation, and shortages. The environment, for some writers, also is threatened by shortages of food (Olembo 1977; Tolba 1979). The final report of the World Food Conference (1977) pointed out that the threat comes from increasing demand for food all over the globe and use of organic and inorganic fertilizers

According to Earl Butz (Gunder Frank 1981:63), a former U.S. Secretary of Agriculture, "Food is a weapon. It is now one of the principal tools in our negotiation kit." U.S. Senator Hubert Humphrey was quoted by Gunder Frank (1981:63) as saying: "Food is power. In every sense it is our extra measure of power." The U.N. Center for Human Rights (1989:12) noted:

Food is a basic need for all human beings. Everyone requires access to food which is (a) sufficient, balanced and safe to satisfy nutritional requirements, (b) culturally acceptable, and (c) accessible in a manner which does not destroy one's dignity as [a] human being....

In sum, food shortages have devastating effects on the well-being of people in developing countries. Yet, there is significant controversy about what causes food shortages in these countries (Wimberley 1991). For some, developing countries are responsible because their beliefs and socioeconomic institutions create obstacles to development (Weiner 1966). According to this group, the major obstacles to development are weak economies, low productivity, poverty, lack of capital, lack of technology, and high levels of population growth. This group uses internal factors to explain the problem of food shortages in developing countries.

On the other hand, there are others who use external factors to explain food shortages in developing countries. This group blames developed countries, arguing that the very process that enhanced the developed countries produced hunger and starvation in the developing countries. They believe that developing countries have not always been poor but they are made poor by developed nations (Gunder Frank 1969; Jaffee 1990). This exploitation of developing countries started with European colonization (Jaffee 1990). According to this group, a different type of exploitation is occurring at present in developing countries. The rise of financial institutions in developed countries and their penetration into developing countries have devastating effects on the well-being of these countries. Multinational corporations brought new type of economic domination to developing countries (Dos Santos 1984).

This study will examine food shortages in relation to major internal and external factors affecting developing countries. The general hypothesis is that dependency promotes food shortages in developing countries.

The next chapter indicates theoretical perspectives, the relevant literature and empirical research on internal and external causes of food problems in developing countries, and theoretical hypotheses. Dependent and independent variables, problems of validity and reliability of the data, and the description of the methodology used is included in Chapter III. Chapter IV reports findings. A summary of findings, study limitations, conclusions, and recommendations are topics covered in Chapter V.

II. THEORETICAL PERSPECTIVES AND LITERATURE REVIEW

Theoretical Perspectives

Without theory it is difficult for researchers in the social sciences to conduct empirical studies (So 1990). Numerous studies have addressed development issues using different approaches. The two most widely used perspectives are the modernization and dependency schools.

Modernization Theory

Modernization is a product of a number of scientists from different social disciplines who were influenced heavily by 19th century theories such as evolution and functionalism. In its simple definition, modernization is the process by which agrarian societies are changed into industrial societies (So 1990). Modernization indicates that internal factors are the most important obstacles for development in developing countries (So 1990). It differentiates between two polar opposites—modernized and nonmodernized societies. The school argues that modernization happens when a relatively nonmodernized country follows the steps of modernized nations. Each society has features differing from others. Nonmodernized (or traditional) societies have low levels of technology, cultural norms of tradition and particularism, and a one-way flow of goods and services from rural to urban areas. On the other hand, modernized societies have a high degree of technology, cultural norms of rationality and universalism, and two-way movement of goods and services between towns and villages (So 1990). Rostow (1960) differentiated between five stages for development—the traditional society, preconditions for take-off,

take-off, drive to maturity, and high mass-consumption. For Rostow, developing countries are in the traditional stage; they need to be stimulated to move beyond the precondition stage. This stimulus can be political, technical, or economic.

Modernization theorists believe that widespread hunger in developing countries is due to their ideological and institutional systems. They believe poverty and its related problems are internally generated (Wells et al. 1983). According to the modernization school, development will occur in developing countries by the provision of needed capital for investment and technology. Developing countries are described as traditional societies because of their traditional beliefs and practices. For modernization theorists, traditionalism is hostile to change or innovation (Weiner 1966). Thus, developing countries require modern factors of production and modern attitudes, values, motivation, and skills (Wharton 1966).

Modernization theory has been rejected by a number of writers (So 1990; Tipps 1973; Gunder Frank 1969), however. According to So (1990), modernization ignored the issue of foreign domination, focused mainly on internal values and attitudes of these societies, and paid no attention to external factors that shaped them (So 1990).

Modernization theory also is criticized for its claim that the diffusion of capital and technology and other development elements are crucial for developing countries. Gunder Frank (1969) believes that the diffusion of capital and technology hinders development rather than promotes it in the developing countries. Modernization also is considered as a product of an ethnocentric world-view (Tipps 1973).

In large parts of Africa, Asia, and Latin America, modernization is characterized by high technology and intensive capital. In countries where there is inequality in power, wealth, and income, the modernization process resulted in increasing the number of peasants with no land and rural poverty (Barraclough 1991). Barraclough (1991) argued that rapid economic growth and modernization are direct causes of abandoning traditional food systems without providing other sources of livelihood for most displaced peasants. For him, this process of modernization is a cause of widespread misery, hunger, displacement, and conflict in a number of developing countries, such as Mexico, Brazil, and Senegal.

Dependency Theory

Dependency is a situation by which the economy of a certain nation is conditional and dominated by the economy of another nation (Dos Santos 1984). From a dependency perspective, the lack of development in developing countries is created by international economic dependence. Dependency theory divides the world into core and periphery, and there is a growing gap between the two blocks. The core is rich, industrial, powerful, and developing. The periphery is poor, traditional, weak, and stagnant. According to this school, the periphery (the developing countries) should eliminate their linkage with the capitalist core (the developed countries) so as to develop.

The power of dependence between the core and the periphery can be seen through different relations ranging from direct military force by colonization to penetration of core investment and aid programs to periphery countries. Multinational corporations (MNCs)

are a good example of a private investment by the core in the periphery. MNCs distort development in the periphery. Wimberley (1990) listed five types of distortion—slowing economic growth, promoting income equality, obstructing progressive domestic political processes that are contrary to core economic interests, diverting land from food production for domestic use, and corrupting local consumer tastes. These issues come under the major topics with which the dependency school deals. Wells et al. (1983) pointed specifically to three major topics of dependency—exploitation, structural distortion, and suppression of autonomous policies. These three topics, as described by Amin (1974) and Borschier and Chase-Dunn (1985), create obstacles and disturbances to steady development and growth of the penetrated country, with negative impacts on the development of the periphery (Wells et al. 1983). Negative impact is explained by Delacroix and Ragin (1986) as weakening the state to implement policies to facilitate development. Dependency indicates that there is a relationship between foreign capital penetration, income inequality, and collective political violence in peripheral countries where penetration exists (London and Robinson 1989).

Evans and Timberlake (1980) completed comparative cross-national analysis in developing countries with regard to dependence, inequality, and the growth of territory. Their focus was on the effects of foreign investment on inequality and labor-force structure; analysis indicated the linkage of dependency to inequality and growth of territory. Evans and Timberlake (1980:546) concluded: "We found a fairly strong, positive relation between the growth of the territory and our measures of inequality and a clear relation between reliance on foreign capital and the growth of the territory sector."

Gunder Frank (1969) is one of the driving forces of the dependency school; he described the world capitalist system as a "metropolis-satellite," where the metropolis (the capitalist countries) took advantage of the satellite (the poor countries). This model explains how the mechanisms of underdevelopment work. The satellite is increasingly dominated by the metropolis and is increasingly dependent upon it. The major argument of the metropolis-satellite model is that transfer of the national surplus produced underdevelopment in the developing countries and development in Western countries (Blomstrom and Hettne 1984). According to Gunder Frank (1969), the developing countries cannot follow the footsteps of the West because their experiences are different. He argued that the developing countries have experienced colonization, while the Western countries have not. Dependency theory indicates that external factors are the most important hindrances for development in developing countries.

The concept of dependence explains that the internal situation of developing countries is a part of world economy. Dos Santos (1984:96) wrote:

...financial relations are, from the viewpoint of the dominant powers, based on loans and the export of capital, which permits them to receive interest and profits, thus increasing their domestic surplus and strengthening their control over the economies of the other countries.

Wimberley (1990,1991) supported the dependency perspective; the promotion of underdevelopment is created by the core/periphery relationship. He investigated the effect of transnational corporations (TNCs) investment in 63 developing countries, finding that it has a harmful effect on infant mortality. A second study (1991) concluded that TNCs corrupt the preference of the people in developing countries by intensive advertising

policies. This behavior of TNCs affected the choices of the local poor. They displaced their cheap, high quality food by expensive, less nutritious foods. Wimberley (1991:428) concluded:

Results presented here indicate that the "engine of development" assumption is untenable with respect to a most fundamental dimension of development: meeting nutritional needs. There is no support whatever for claims that TNCs help alleviate hunger. On balance, transnational corporate investment appears to promote it.

Another sociologist who applied dependency theory to the global food shortages is de Janvry (1976-1977). He noted that the problem includes uncertainty concerning food production, population, and nutritional needs. He argued that the population in the periphery had not improved their nutritional standards, but rather they deteriorated through the years. For him, hunger can be explained by six points—population growth and limited resources, slow diffusion and absence of modern technology in the periphery, market distortions and lack of investment in technology and education for developing countries, the land tenure system, consumption habits in core nations, and reformism. De Janvry (1976-1977:25-26) concluded that the center dominates the periphery; for him, the core/periphery relationships

...established by the domination of center over periphery, bring about unequal exchange in trade and financial and industrial imperialism. Surplus food production in the center, internationally cheap food, collapse of peripheral agriculture, and functional dualism with a large subsistence sector are integral components of these relationships. And so is the food and hunger crisis.

For Toton (1988), the core countries were responsible for dominating and structuring world trade systems and aid so as to sustain the stability of their economic,

political, and social systems. Toton argued that about 80 percent of the developing nations' trade flows between them and the industrial countries. The developing countries lose an average of \$2.5 billion annually because of the deterioration of the rate of exchange in the market. Toton (1988:27) stated: "If our observations are correct, it should become clear that hunger is not an isolated problem but is one of the more visible effects of policies structured to protect and promote the interest of our own economic system." The dependency perspective predicts that penetration of foreign investment in periphery nations is harmful. Most studies that have examined dependency theory, such as Chase-Dunn (1975), Evans and Timberlake (1980), and Bornschiefer and Chase-Dunn (1985), came to similar findings. Penetration of foreign investment creates inequality and has harmful effects on people's well-being and on food intake in peripheral nations.

Dependency is considered a macrosociological and methodologically promising perspective (Valenzuela and Valenzuela 1981). However, it has been argued that dependency on others for growth is not a peculiar thing; as an example, Canada depends on the United States for its development (Webster 1984). Also, dependency theorists were found to be wrong about "technological dependency" when they claim that those who control the creation of technology also have the capacity to control its exploitation. Examples found in other countries, such as Argentina and Canada, prove otherwise (Blomstrom and Hettne 1984). Also, dependency theory needs to clarify its concepts and to "...assess its capacity to explain the social process in various parts of peripheral societies" (Valenzuela and Valenzuela 1981:34).

Dependency theories have been criticized because of their view of dependent countries as integral parts of the capitalist world system and that the dynamic forces of that system are located outside the dependent countries (Bornschieer and Chase-Dunn 1985). Bornschieer and Chase-Dunn (1985) also criticized the dependency school for introducing the notion of core/periphery to explain the dependence of the developing countries. They argued that within both core and peripheral countries there are central zones and peripheral zones. Dependency also was criticized for neglecting factors such as class structure in developing countries that could be responsible for underdevelopment. In explaining this, Blomstrom and Hettene (1984) argued that, according to Marx, relationships between classes are governed by the modes of production. Thus, it is important to examine the type of production in developing countries because they contain the causes of underdevelopment. Most development theorists believe that development is not only an economic problem, but a political, social, and cultural problem.

In sum, this study will focus on the dependency perspective. This is because dependency theory views development from the point of view of developing countries. Dependency is believed to be an external condition that is imposed from outside. Many developing countries, if not all, suffer devastating economic conditions, such as declining terms of trade with Western countries. The dependency perspective arose in order to analyze economic conditions in Latin America and to search for solutions to economic problems. Furthermore, "surplus drainage" is considered a manifestation of the international exploitation of developing countries by developed countries. This is considered a major argument for the dependency theory (Jaffee 1990). Finally, the

impacts of dependency theory on development strategies was considerable (Blomstrom and Hettene 1984). Dependency has more success in predicting the effects of inputs from developed to developing countries than international economic theories or sociological modernization theories (Chase-Dunn 1975).

Literature Review

Factors affecting food production

To gain a better understanding of food shortages in developing countries, the study will measure the food shortage once in 1985 using calorie intake as the empirical measure; also food shortage will be measured in a longer period 1975 through 1985 using calorie change as a measure. Calorie change will give a better understanding of major causes that affected food shortage at a wider scope.

However, causes of global food shortages in developing countries can be approached from two broad perspectives—internal factors and external factors. Traditional values, beliefs, and practices are considered obstacles for development in developing countries. From a modernization point of view, countries must change these internal factors to develop, while external factors, such as penetration of foreign capital into developing countries, are seen as major obstacles from the dependency perspective.

Internal factors. The World Food Conference of 1976 listed six human resource problem areas as the most important factors affecting food in developing countries. These were (World Food Conference 1977:659): "...urban bias; lack of incentives; compartmentalization of program planning and delivery systems; quality of life in rural

areas; the shortage of relevant educational materials; and population, or numbers of people." These internal problems can be considered under major headings such as government policies, agricultural practices, political instability, economics, and poverty. Both Weiner (1966) and Kotter (1977) believe that the major obstacles of food production occur within developing countries.

Government policies. The major areas that have been discussed by writers are overpopulation, urban bias, over-urbanization, and cash-crop policies. Paddock and Paddock (1976), Grigg (1985), and Vicker (1975) believe that the major cause of food problems is increasing population accompanied by static growth of agriculture in many parts of poor nations. For Brown (1974) and Josling (1977), population pressure and accelerated growth in the global demand for food since World War II are the causes of today's food crisis. According to Grigg (1985), population in Africa, Asia, and Latin America between 1950 and 1980 increased far more rapidly than in any part of the world before 1950, with the rate of growth greatest in developing countries. Yates (1986) explained growth of population in developing countries by arguing that they need cash crops to pay back interest on their debt; as a result, the poorest people in increasing numbers will try to subsist on marginal land, and this, in turn, results in famine.

Writers such as Borgstrom (1973) and Lerner (1967) look at the food problem from economic and ecological points of view. For them, affluent nations are no less overpopulated than poor nations; the difference is that people in affluent areas can migrate to a new land when food is scarce (about 100 million Europeans left Europe between 1850 and 1880) while the residents of poor nations have no such option. Sen (1990)

argued that the major feature of food shortage in the developing countries, particularly Africa, is the general lack of economic growth altogether.

For Vicker (1975), Lipton (1984), and Grigg (1985), over-urbanization and urban bias are other major causes. Mellor (1988:1002) criticized local institutions in developing countries: "Unfortunately, the investment norm in many developing countries is to neglect the countryside and to concentrate the bulk of resources in a few major urban centers and in highly capital-intensive industry." Because of this policy, Mellor explained, the growth rate of agricultural production in developing countries is below average. For Cheng (1989), over-urbanization and related issues, such as rapid service sector growth, are factors leading to the failure of agriculture in many developing countries.

Much attention has been given to the food industry in developing countries. It is considered to be one of the major causes of the food problem (de Janvry 1976-1977). Markov (1977) stated that from 1950 to 1970, food industry output in these countries increased by 170 percent (260 percent in Africa, 180 percent in Asia, and 150 percent in Latin America) and about 70 percent in developed countries. Cheng (1989), Kumar and Lipton (1988), Yates (1986), and Norse (1979) agree with Markov (1977) and believe that the food problem is created because governments in developing countries put more emphasis in promoting cash-crop production and the production of raw material for export and provide fewer resources for food production improvement. This behavior results in displacement of poor farmers who have no alternative other than move to the city and live on its margins (Wimberley 1990). George (1984) and dos Santos (1984) relate this

behavior to the fact that most governments in developing countries help multinational corporations control their agriculture.

Agricultural practices. Grigg (1985) traced food production in developing countries, with special emphasis on agricultural practices. Although traditional agricultural practices, such as shifting cultivation, had been used for centuries to maintain the fertility of the land in Africa, they require a long fallow period and abundant land. In traditional societies, Grigg (1985) noted that with the increase of population, land has become less available and the fallow period has been reduced. Other scholars also expressed concern about the shortcomings of traditional agricultural practices in developing countries, such as lack of fertilizer, machinery, and adequate water control systems as well as improper land reform (Witter 1977; Cheng 1989; Sen 1990).

On the other hand, Warren and Cashman (1988), Titilola (1990), and Rau (1991) argue that indigenous knowledge in developing countries can play a significant role in the development of agricultural systems. Titilola (1990:2) noted that small scale farmers who have very limited resources have managed to "...develop complex cropping systems capable of providing a continuous supply of food while maintaining soil fertility." This is because farmers in many developing countries have a wealth of knowledge about their environment. Warren and Cashman (1988:9) stated: "...indigenous knowledge comprises an extensive array of responses to changes in the cultural, physical, or economic environment and can provide useful insights for modern research and extension." For Barraclough (1991), the process of modernization in developing countries may lead to accelerated degradation and misuse of natural resources, such as soil, forests, and water, to

pursue quick economic gain. Agriculture also suffers from other problems as well, including economic and political instability in developing countries.

Economic and political stability. Major factors affecting economic development, such as the size of the country, its historical evolution, its physical and human resources, and distribution of its political power (Todaro 1977), vary from country to country. Yet developing countries also share some common characteristics. Todaro (1977:24) noted six broad categories of similarity—low levels of living; low levels of productivity; high rates of population growth and dependency burdens; high and rising levels of unemployment and underemployment; significant dependence on agricultural production and primary product exports; and dominance, dependence and vulnerability in international relations. Gross national product (GNP) often is used as an indication of the well-being of the people in different countries. The World Development Report of 1980 (World Bank 1981) stated that the GNP per person in industrialized countries was \$9,684 while it was \$245 in developing countries; the average annual growth between 1960 and 1980 in developed countries was 3.2 percent while it was 1.7 percent in developing countries during the same period.

The economic situation of a developing country frequently is considered to be characterized by backwardness, inefficiency, and relative stagnation (Rostow 1960). For countries to develop, they have to get to the "take-off" stage, which indicates the end of previous obstacles to growth (Rostow 1960). Economic difficulties are caused by problems such as political instability. For example, inefficient food production, as explained by Pesqueira (1990), Waller (1990), and Rau (1991), is caused by political

unrest and internal conflicts in developing countries; these lead to the negligence of the agricultural sector and force many rural residents to move into urban areas. Grigg (1985) shared similar ideas; he described Africa as the continent that had the least successful food record, with government food policies, instability, and civil wars cited as the major causes. Pesqueira (1990), the former president of the World Food Council, and Waller (1990) argued that internal conflicts and political violence are factors responsible for causing instability, environmental hazards, and food shortage in many developing countries, with wars acting as a major cause of serious famine and hunger in both developed and developing countries. Displaced persons and refugees are the most affected (Barraclough 1991).

For Jennings and Street (1989), the major problem is the persistence of economic crises in developing countries. Their argument stressed the steady decline of production per capita; the agricultural sector saw little improvement over the last three decades. Among other economic problems was the ineffective marketing system in Africa and other developing countries (Meissner 1989; Gacitua and Bello 1991; Cheng 1989). The World Food Conference of 1976 considered ineffective marketing, and especially lack of capital, in the developing countries as a central problem; other factors include the lack of coordination in production, lack of infrastructure, excessive waste in food distribution, and lack of adequate agricultural practices.

However, Freeman, pointed out that the problem of feeding the people of the world can only be met in the developing countries where tropical conditions permit triple and even quadruple cropping. Freeman said (Vicker 1975:254): "Ironically, the technology to

produce efficiently in these areas is available; new seeds, fertilizers and chemicals make it possible. But to apply this technology effectively requires investment, know-how, skill and good management." These requirements are too expensive for developing countries to meet.

Poverty. Chambers (1983:36) quoted Kuiven, who defined poverty as "...the socioeconomic phenomenon whereby the resources available to a society are used to satisfy the wants of the few while the many do not have even their basic needs met." There is an increasing concern in the literature about widespread poverty in poor countries and even in some of the rich countries. Many governments in developing countries ignore the poor and lack effective policies and programs to feed them (Pesqueira 1990; Stokes and Anderson 1990; Food and Agriculture Organization 1989).

Poor societies lack advanced technology and research. These factors handicap economic growth in developing countries. According to some scholars, any effort to help poor countries should come from within these societies themselves (Chirot 1977). Even in rich countries such as the United States, undernutrition is associated with poor people and affects about one-tenth of the population (Barraclough 1991). Food insecurity is more associated with national poverty rather than with global shortages of food, according to Barraclough (1991).

The number of people in poverty in the world in 1990 was 1.1 billion, with one-third of these in India (Abbott 1992). Half of the people south of the Sahara in Africa were below the poverty line, as were most of those in northeast Brazil and the Latin American mountain zones. According to Abbott, the major causes of poverty are

population increase, high indebtedness, successive years of drought, and continuing civil wars. Grigg (1985:55) commented on the causes of poverty in developing countries: "At any one time the existence of undernutrition or malnutrition is surely due to poverty—to the lack of income, employment opportunities or sufficient land. But, over time, population growth is equally surely one cause of poverty." Yates (1986) indicated that poverty is greatly aggravated by rapid population increase in the developing countries.

One of the major causes that related to poverty in developing countries is persistently paying back debt interests (Dadzie 1988). Manley (1991) argued that the majority of developing countries were obligated to pay about one-third to two-thirds of their gross export returns to the service of debt. Manley (1991:12) quoted the Brandt Commission Report: "The North, including Eastern Europe, has a quarter of the world's population and four-fifths of its income; the South, including China, has four billion people—three-quarters of the world's population, but living on one-fifth of the world's income."

In sum, government policies, economic situations, political instability, poverty, and other internal factors within developing countries have colored social and economic structures in these countries. Socioeconomic problems in nearly all developing countries can be related to some extent to the internal factors. But internal factors are not the only ones responsible for the living standards of the people in these countries. External factors, such as colonialism and imperialism, also affect these societies.

External factors. The major external causes of food problems in developing countries that are noted in the literature include agribusiness, colonialism and imperialism,

and external debt. Toton (1988:x), who believes that developing countries were not simply poor but were made poor, stated:

I felt that there had to be some relationship between the structured dependency of the Third World and its hunger. I continued to research the trade, aid, and investment policies of the First World with the particular interest of determining whether those policies contributed to the hunger of the Third World. My findings were true to my original insight.

Agribusiness. One of the major tools for agribusiness in developing countries is multinational corporations (MNCs). MNCs are the organizational embodiment "... of imperialism, the metropolis, monopoly capital, and the core of the world system" (Jaffee 1990:175). Jaffee agreed with Gunder Frank (1981) that foreign investments (MNCs) in developing countries promote underdevelopment, stagnation, and economic backwardness. For Wimberley (1990), transnational corporations (TNCs) aggravate food shortages and hunger in the developing countries. TNCs "...reduce effective demand for food through a variety of social, economic, and political distortions" (Wimberley 1990:412).

Bornschiefer and Chase-Dunn (1985) studied the impact of the penetration of large private firms into 103 developing countries. They found that although the penetration of foreign investment had a positive effect in the short run, high degrees of penetration and control by MNCs retarded development and increased inequality in developing countries. London and Williams (1988) studied 86 peripheral countries by examining the impact of both penetration of foreign investment and levels of domestic political protest on the provision of basic needs and the growth of national development. They noted that economic growth in many nations does not mean improvement of living standards and equality between the people in these nations. They argued that the lack of capital and

technology necessary for development force many developing countries to compete with each other to attract foreign investment to their countries. In this process, developing countries offer the needed resources to be controlled by foreign investors.

Bornschieer and Chase-Dunn (1985:81) argued: "Transnational corporations, after facing potential or actual overcapacities, start to take surplus out of the penetrated country. This means that their efforts to generate higher income for themselves affect the growth potential of the penetrated country adversely." A similar view is held by Lappe and Collins (1977, 1979), who deny resource scarcity in the affected countries. They emphasize that natural resources in the poor countries are controlled by economic elites and MNCs. For them, overpopulation is not an issue causing a shortage of food and leading to hunger. They argue that in Africa, where chronic hunger exists, there are almost two-and-one-half cultivated acres per person, which is higher than in the United States, the People's Republic of China, and the former Soviet Union.

Colonization. Although many developing countries have more than enough land for their people, they do not benefit much from it because it is dominated and exploited by external powers. Colonization began during the late 15th century. According to Toton (1988) and Rau (1991), Europeans seized lands in other areas from indigenous populations and extracted precious metals and tropical products. To colonizers in Africa, Asia, and Latin America, agriculture meant a means of extracting wealth; and agriculture is no longer a source of food for the local population, nor even the livelihood for many (Lappe and Collins 1977). For George (1984) and Rau (1991), colonization contributed to the world food crisis. The old empires commandeered other nation's food production. Both

of these authors provided examples from around the world, such as the British Peruvian Amazon Company in Latin America, the French in Niger, and the Belgians in the Congo. For example, George (1984:23) stated: "Mercilessly crushing the old African agrarian system, the finance companies proceeded to make gigantic expropriations, seizing millions of hectares, burning villages...forcing [the people] to gather plantation crops at gunpoint."

The majority of African countries and some in Asia and Latin America were colonies of European countries that gained their political independence not long ago. Most of these countries continue to struggle to evolve their political and economic structures. Many countries, especially in Africa, still are trying to define their identities. The processes of achieving this goal are long and costly. Due to this and other socioeconomic factors, civil wars and political violence prevail in a number of these countries.

Many of these countries remain colonies or satellites in an economic sense to Western or metropolis countries. Many developing countries are vulnerable because they depend on one or two commodities. For example, in Africa, where the style of development is largely controlled by colonial and post-colonial dependence, 60 percent of the total exports are coffee and cocoa; in Latin America 70 percent of the total exports are sugar, coffee, and soybeans; and 60 percent of the Near East's exports are fruits, vegetables, and cotton (Grigg 1985; Barraclough 1991; Rau 1991). Rau (1991:74) stated:

The famines in Africa in this century have been man-made. They have been the result of decisions to organize national economies in specific ways. The processes which determined those decisions originated early in the colonial era and were strongly reinforced at the time of independence.

It is believed that imperialist policies became an obstacle for early and effective solutions of food problems (Manley 1991; Markov 1977). The resources of the poor nations (periphery countries) and the international trade systems are largely controlled by the West (the core) in order to meet the needs of their own people (Borgstorm 1973). The economic control by the West is done by, among other things, colonialism and/or neocolonialism. For Yates (1986:82) neocolonialism is "...the system of unfair exchange which means over half the world's population supply the rich nations with necessary raw materials at declining returns, because they have incurred ever-increasing debts." Colonialism may be over. But it left behind an indelible effect on all the societies in which it occurred (Lappe and Collins 1977).

Foreign economic control. In many cases, developing countries cannot unchain their economies from foreign economic control. Borgstorm (1973) argued that the developing countries are controlled economically and one of the tools of this control is external debt, which is considered to be one of the main factors of the global food problem. It has been argued that (United Nations Center for Human Rights 1989:7):

[d]ebts that they cannot pay force African nations relying on commodity sales to overuse their fragile soils, thus turning good land to desert.... As a consequence of the "debt crisis" in Latin America, that region's natural resources are now being used not for development but to meet financial obligations to creditors abroad.

The total debt of developing countries is estimated at about \$10 trillion, which is about 10 percent of the annual global economic activity (George 1988). It is predicted that debt crises will remain in developing countries for a generation or more, even if all the debts of the developing countries were wiped out immediately (Singer 1992). Developing

countries witnessed heavy declines in gross domestic investment, which was growing by 8.4 percent during the years 1965-1980, but declined by 3.1 percent per year during the past decade. External debt is an economic austerity killing millions in the developing countries; and it is a direct cause of poverty and hunger (George 1988; Singer 1992). George (1988:5) noted: "Over \$130 billion net—repayments minus new loans—has left Latin America and landed in northern banks in the past five years alone. Banks are also beginning to take over national industries and other assets in the Third World in lieu of interest payments."

Chase-Dunn (1975:720) conducted a cross-national study on the effects of international economic dependence on development and inequality. He defined two kinds of international economic dependence; investment dependence is the "...penetration of a country by foreign capital and debt dependence...is the dependence of a government on foreign credit." His findings indicated the negative effects of both kinds of dependence on economic development and a positive effect on income inequality. Chase-Dunn claimed that investment dependence retards economic development. Others, such as London and Robinson (1989:307), who studied political violence in developing countries, concluded that it is the "...multinational corporation, not income inequality, that directly accounts for increased levels of collective political violence experienced by nations." Rau (1991) believed that many natural resources of Africa that went for development were channeled to serve external interests.

In sum, nearly all scholars who are concerned with global food problems are looking for solutions. Pesqueira (1990) called for fundamental changes in current food

policies and a solid political commitment from throughout the world to overcome these problems; otherwise, there will be an enormous increase in the cost of effective action. Paddock and Paddock (1976) were pessimistic; they believed that the combination of little food, many people, and minimal research created major difficulties.

Theoretical Framework

The phenomenon of hunger in developing countries and other parts of the world must have causes; people do not become hungry because they want to be hungry (Wells et al. 1983). Explaining the causes of hunger requires a theoretical framework leading to the general hypothesis that dependency promotes food shortages in developing countries.

Dependency is substantial for most developing countries (Todaro 1989). In some developing countries dependency affects almost all aspects of life. Todaro (1989) argued that these countries lack the ability to chart their own economic, social, and political life because they are affected by the degree of dependence on external factors. In explaining this, Jafee (1988) noted that dependency has harmful effect on developing countries because of unequal exchange between developing and developed countries. Colonial systems left in many developing countries, he argued, depend on one or two low-cost agricultural commodities whose prices are controlled by developed countries. In return, developing countries import high-cost manufactured goods produced and also controlled by developed countries. In addition, developed countries established trade restrictions against imported commodities from developing countries. This fact, according to Jafee

(1988), decreases the ability of developing countries to earn foreign capital to import needed food items to feed their residents.

When developing countries emerged after World War II as newly independent nations, Western countries decided to help them to develop. Many financial institutions based in the West started to send capital and technology into these countries. One way of capital and technology penetration is through multinational corporations (MNCs). Many developing countries depend on MNCs to bring in technology and capital needed to help promote their economies and to pay back their external debt. Repaying interest of external debt is considered a major obstacle which leads to shortages of basic needs such as food in developing countries, however.

MNCs have been criticized for being a facade of international capitalism because their ultimate goal is not meeting basic needs of developing countries such as food but rather maximizing their own profits (Todaro 1989). To achieve their goals, MNCs seek help from local elites whose interest is in the penetration of the international capitalist system by which they maintain high socioeconomic status (Todaro 1989). MNCs are believed to monopolize almost all agricultural resources—land, capital, labor, credit, research, and technology (mechanization). Because of this, poor residents—the majority in developing countries—have no control over their own food production, which promoted food shortages among this segments of population. About half of the agricultural land in Latin America produces food for export while fifty percent of the population eat half what they actually need (Jafee 1988). Multinational corporations also are criticized for creating decapitalization and displacement of indigenous firms and promoting income inequality in

developing countries (Wimberley 1990). Income inequality causes economic difficulties; these would lead to political unrest, political instability, and food shortages (Pesqueira 1990).

George (1977) and Jafee (1988) accused the West of reinforcing inequities in developing countries. They argued that developing countries depend on the West to educate and train their elites in the fields of research and extension. This fact makes these trainees more receptive to Western forms of development programs and help Western organizations, such as MNCs, to benefit from this situation in developing countries. George (1977) gave an example of the Green Revolution, which requires large amounts of water, fertilizers, and chemicals. The real beneficiaries, he argued, are large farmers who can afford to provide these things from Western companies and corporations. Poor farmers who can not afford the new technology will be displaced.

Since the fifteenth century most developing countries were satellites of European countries as colonies and were totally dependent on colonial powers. During the Industrial Revolution these colonies became an invaluable asset to colonizers. They were primary sources for raw materials and markets for manufactured goods. During this process their economic structure, education, and social institutions were reshaped by colonial powers. Countries that formerly produced enough food for their people were no longer able to do so because farming systems had been changed to meet the colonizer's needs. More agricultural lands were used for products other than food.

However, one of the main reasons for the inability of developing countries to meet the needs of their people is because they can not generate enough capital. Most of these

countries are forced to depend on the West to meet some of these needs such as food. Experiences of countries such as China and Cuba have proven that if they are given the chance to control their own farming systems, they may be able to feed their people from domestic food production (Toton 1988). But it is not easy for developing countries to accumulate enough capital because they are under control of the international capitalist system. Toton (1988) argued that for the capitalist system to survive it must create markets for its production. Aid is considered one of the tools by which the West expands its markets into developing countries. In other words, the West needs the developing countries and depends on them to maintain its high quality of life (Toton 1988). According to this argument, developed countries flourish through exploitation of developing countries. Thus, in general, it hypothesized that dependency is harmful and promotes, among other things, hunger in developing countries.

Theoretical Hypotheses

Between 1970 and 1975, the international community faced a number of crises that affected food production in all countries, but particularly in developing areas. Toton (1988) listed four crises that affected food production. First, a cut-back in food production occurred because grain surpluses reached a peak and drove prices down, which reduced profits; second, bad weather in the former Soviet Union, Argentina, Philippines, and India had a devastating effect on food production; third, there was a decline in world fish catch; finally, oil prices increased. The early 1970s are considered the beginning of

the world food crises. Most of the developing countries were affected (Toton 1988; Grigg 1985; Mensah 1977).

Increasing population growth is considered to be one of the major governmental policies in developing countries (Brown 1974; Josling 1977). De Janvry (1976-1977) stated that population growth is the major cause of poverty and hunger. Countries with rapidly growing populations face the problem of having a young, nonproductive population facing food shortages (Grigg 1985; Paddock and Paddock 1976; Vicker 1975). There is a positive correlation in many developing countries between malnutrition and high density of population (Mensah 1977). This has been related to poverty in developing countries where fecundity is induced by socioeconomic and cultural factors. In turn, inflated fecundity leads to shortages of food and malnutrition (Mensah 1977). In many African countries, rising population density has caused reduction of farm size and reduction of use of indigenous agricultural systems. This has affected land fertility and consequently its production. Rapid population growth of the last 50 years has led to problems of population pressure on land in several parts of Africa (Grigg 1985). This resulted in low food productivity, which leads to malnutrition. Grigg noted that the major problem that Asia will face is to absorb its increasing population rather than to increase food production. Thus, it is hypothesized that the higher the population growth, the greater the problem with food shortages and the greater the increase in shortages of food over some period.

Developing countries are less likely to have mass food production because of their traditional political conditions. For developing countries to reach the take-off stage to

increase agricultural productivity, research and technology have to be available (Pesqueira 1990). Pesqueira called for developing countries to enhance rural infrastructure, use of fertilizer, and access to credit. In developing countries, food production needs to be increased much faster than in the past (Kotter 1977). One way to rapidly increase food production is by improving the methods of fertilizer placement (Witter 1977). Another way is mechanization on a large scale; Kotter (1977) argued that an appropriate approach to mechanization of agriculture will achieve two goals: increase food production and help develop rural industries. Mass food production is one of the major solutions of hunger and malnutrition in developing countries. Thus, it is hypothesized that the less modernized are agricultural methods, the greater the problem with food shortages and the greater the increase of these shortages over some period.

It is estimated that more than one-half of the people in the world are in countries with low average income (Hagen 1980). For many writers this is the principal cause of hunger and malnutrition (Grigg 1985; Seligson 1984; Chambers 1983). For these scholars, the progress of economic growth in developing countries explains the persistence of hunger. In almost all poor nations, agricultural production is by peasants cultivating small areas that frequently are rented. It has been argued that these small farmers, who represent the majority of the rural population, lack effective policies and programs needed for subsistence. The root of the problems for these nations is change in income and how it is distributed (Grigg 1985). The rural poor lack income and are the most vulnerable, suffering more from poverty and hunger. Thus, it is hypothesized that the lower the gross

national product (GNP), the greater the problem with food shortages and the greater the increase in shortages of food over some period.

It has been argued that wages paid by big firms located in peripheral nations are higher than those received by other citizens (London and Robinson 1989). This creates inequality. In addition, governments in developing countries attract large firms by policies designed to provide special privileges, such as guarantees of profit and lower labor costs. These policies generate instability and, in turn, political violence (Chase-Dunn 1975; London and Williams 1988; London and Robinson 1989). Instability in a country impedes public and private efforts for development (Wells et al. 1983). As a consequence, the country faces shortages of production, including food. Sudan experienced famine in 1983-1984 and again in 1987-1989. The two major causes of these famines were drought and civil war, which have been occurring off and on for more than three decades. The country still suffers from the civil war, which resulted in the death of tens of thousands from malnutrition and hunger. In Somalia, thousands of children and adults died because of hunger and malnutrition due to political violence and civil war. During such times, local farmers are forced to leave their villages and areas for protection elsewhere. This displacement results in abandoning agriculture and creates food shortages in these areas. In most cases, local governments and other human organizations would not be able to reach the victims with food. Thus, it is hypothesized that the longer the period of political instability, the greater the problem with food shortages and the greater the increase in these shortages over some period.

Poverty is described as a trap set for developing nations by developed countries (Yates 1986). Some developing countries were able to increase their economic growth rates without achieving success in alleviating poverty (Toton 1988). Poverty is considered a major cause of malnutrition in developing countries. Many of these countries give priority to the production of cash crops and verbal support to subsistence crops; this policy resulted in growth without development (Cheng 1989), which has been criticized for being responsible for food shortages and hunger in developing countries (Lappe and Collins 1977; Cheng 1989). The increase of food production may lead to an increase of GNP; but the increase of food production may not be a solution for shortage of food in developing countries, because of food distribution problems (Cheng 1989). India is a good example, where poor people cannot find enough nutritious food to eat while stores are full of food crops ready for export.

Absolute poverty means lack of income or wealth that enables people to meet their basic needs, such as food, shelter, and clothing. Poverty is considered a cause of political unrest, violence, and malnutrition to a vast majority of the population in developing countries (Seligson 1984; Chambers 1983). Chambers argued that the poor are the most vulnerable people and that poverty dominates the peasants' sector where hunger and malnutrition are concentrated. The number of people in poverty are increasing in the world, especially in Africa, Asia, and Latin America (Harrison 1984). The gap between rich and poor is increasing. Poor people who cannot afford to eat enough food cannot afford to protect themselves from disease or be productive. Thus, it is hypothesized that

the higher the rate of poverty, the greater the problem with food shortages and the greater the increase in these shortages over some period.

Some hypotheses can be derived from the effect of foreign investment in developing countries. Foreign investment is said to be harmful and does not alleviate malnutrition and hunger (Wimberley 1990, 1991); MNC investments have retarded development (Bornschiefer and Chase-Dunn 1985). Governments in developing countries encourage foreign investment to finance different labor-intensive industries in urban areas. To compete, these governments offer more national resources to promote production for export and fewer resources and funds for food production (Cheng 1989). These policies have contributed to food shortages, reduction of calorie intake, and hunger in developing countries. Thus, it is hypothesized that the higher the penetration of foreign investment, the greater the problem with food shortages and the greater the increase in these shortages over some period.

For Wells et al. (1983), another form of dependence is by direct military force through colonialism. Capitalist economies needed to grow; they expanded their areas of colonial domination to acquire resources (cheap raw materials) and to open new markets for their products (Chirot 1977). The relationships between colonial powers and their colonial territories reflect the pattern of the metropolis-satellite perspective by which the metropolis exploits and extracts economic surplus from the satellite (Taylor 1991; Blomstrom and Hettne 1984). Taylor argued that imperialist dominance created, among other things, civil wars, hunger, and famine in the periphery. The impact of long French colonial rule in Algeria was devastating to rural Algeria; Heffernan and Sutton (1991)

argued that rural settlements were subjected to policies that destroyed crops, created ineffective agricultural production, and forced many traditional rural villagers to migrate. The main focus of colonization is to extract resources with no regard to the needs of national consumers or the interests of local producers. In the process, indigenous food production systems in many developing countries were destroyed, resulting in food shortages and hunger. Thus, it is hypothesized that the longer the existence of colonization, the greater the problem with food shortages and the greater the increase in these shortages over some period.

It has been argued from a dependency perspective that dependence relations can be seen as foreign aid for poor countries (Wells et al 1983); foreign aid from capitalist countries to developing nations is considered exploitation and not aid (Gunder Frank 1969). Extended debt has produced a number of serious problems in many developing countries, such as shortages of basic imports, declining production (including food), and growing hardship among the poor (Parfitt and Riley 1989). George (1988:217) quoted Perez, who connected external debt to malnutrition and hunger: "In my country, the conditions imposed by IMF forced us to apply mistaken economic policies [bringing] about...a deterioration in nutrition, which hit the poor hardest of all." Indebted countries, in order to repay their creditors, focus their development plans on industry and low-priced commodities for export. This process has led to shortages in foreign exchange which, in turn, led to local shortages of essential goods, such as food (Parfitt and Riley 1989). Thus, it is hypothesized that the higher the foreign debt dependence, the greater the

problem with food shortages and the greater the increase in these shortages over some period.

III. DATA, METHODS, AND EMPIRICAL HYPOTHESES

Information from 89 developing countries will be used to test hypotheses.

According to world economic classifications, countries are either developed (industrial economics) or developing (traditional economics). In developing countries, between 70 to 90 percent of the population is engaged in agriculture. There are limited employment opportunities in other sectors, causing low capital per person. For the majority of developing nations, productivity and standard of living (life expectancy, adequate diet and calorie intake, education, health care) are low. Also, development is not equally distributed among the different social groups, regions, and economic institutions (Bornschieer and Chase-Dunn, 1985; Chambers 1983).

One of the initial objectives of this research was to study 124 countries: 100 developing and 24 developed. Because of the lack of necessary data for most of the developed countries, such countries were dropped from the study. Among the 100 developing countries, data were missing in some cases, especially for 11 countries. These countries were Namibia, Reunion, Martinique, Afghanistan, Cambodia, Democratic People's Republic of Korea, Puerto Rico, New Caledonia, Cyprus, Oman, Trinidad and Tobago. Data concerning the remaining 89 countries were acquired through well-established and highly-reputed sources. Most of the data are based on publications issued by the United Nations and the World Bank.

Dependent Variables

A commonly used empirical measure of food shortage, which is the dependent variable in the theoretical hypotheses, is calorie intake (Wimberley 1990), in part because it is considered to be a good indicator of other nutrients (Gacitua and Bello 1991). Calorie intake per person per day will be the empirical indicator of the dependent variable. Per capita figures represent only the average supply available for the population as a whole and do not necessarily indicate what is actually consumed by individuals, of course. Data for calorie intake were taken from the data base constructed by the U.S. Department of Agriculture on World Agricultural Trends and Indicators, 1970-1988. This bulletin provides aggregate economic and agricultural growth performance indicators for the world for four economic groupings of countries and for 160 individual countries that contain 99.7 percent of the world's population. Calorie intake was measured in 1975 and in 1985 (Tables 1, 2).

Based on the calorie intake per person per day, the 89 developing countries can be divided into three groups nearly equal in number. These groups are defined as low calorie intake (2,249 calories or fewer per person per day), medium calorie intake (2,250-2,599 calories per person per day), and high calorie intake (2,600 calories and up per person per day). Twenty-nine countries fell in the first category of low calorie intake per person per day. The country with the lowest calorie intake in 1985 was Sumatra (1,267 calories per person). Thirty-one countries belonged to the medium calorie intake group and 29 countries fell in the high calorie intake category for the year 1985. The highest among them was Libya with a calorie intake of 3,538.

Table 1. Calorie intake in developing countries, 1975 and 1985

Country	Calorie intake per person per day		
	1975	1985	Change
Central America:			
Belize	2500	2593	93
Costa Rica	2537	2733	196
El Salvador	2073	2375	302
Guatemala	2152	2234	82
Honduras	2058	2017	-41
Mexico	2798	3172	374
Nicaragua	2385	2575	190
Panama	2308	2422	114
Cuba	2626	3087	461
Guadeloupe	2424	2694	270
Haiti	1961	2101	140
Jamaica	2440	2515	75
South America:			
Argentina	3289	3216	-73
Bolivia	2050	2269	219
Brazil	2471	2560	89
Chile	2550	2546	-4
Colombia	2233	2491	258
Ecuador	2039	2052	13
Paraguay	2500	2623	123
Peru	2270	2161	-109
Uruguay	2892	2736	-156
Venezuela	2473	2529	56

Table 1. (continued)

Country	Calorie intake per person per day		
	1975	1985	Change
Sub-Saharan Africa:			
Angola	2106	2260	154
Benin	2040	2193	153
Botswana	2264	2315	51
Burkina Faso	1791	1833	42
Burundi	2451	2337	-114
Cameroon	2340	2070	-270
Comoros	2469	2404	-65
Congo	2314	2331	17
Cote d'Ivoire	2312	2519	207
Ethiopia	1516	1603	87
Gabon	3216	2854	-362
The Gambia	1933	2088	255
Ghana	2116	1783	-333
Guinea	1915	1679	-236
Kenya	2243	2270	27
Lesotho	2029	2284	255
Liberia	2181	2330	149
Madagascar	2522	2360	-162
Malawi	2473	3381	908
Mali	1814	2060	246
Mauritius	2566	2745	179
Niger	1941	2204	263
Nigeria	1820	1983	163
Senegal	2167	2247	80

Table 1. (continued)

Country	Calorie intake per person per day		
	1975	1985	Change
Sub-Sahara Africa: (continued)			
Sierra Leone	1949	1848	-101
Somalia	1553	1267	-286
Sudan	2088	2093	5
Tanzania	2086	2293	207
Togo	2080	2174	94
Uganda	2218	2413	195
Zaire	2207	2119	-88
Zambia	2309	2126	-183
Zimbabwe	1989	2180	191
North Africa and Middle East:			
Algeria	2178	2647	469
Egypt	2628	3163	535
Iran	2916	3165	249
Iraq	2326	3050	724
Jordan	2311	3152	841
Kuwait	2691	3216	525
Lebanon	2226	2474	248
Libya	3510	3538	28
Mauritania	1897	2443	546
Morocco	2460	2701	241
Saudi Arabia	1969	2567	598
Syria	2542	3331	789

Table 1. (continued)

Country	Calorie intake per person per day		
	1975	1985	Change
North Africa and Middle East (continued)			
Tunisia	2589	2891	302
Turkey	2937	3088	151
United Arab Emirates	3398	3143	-255
Yemen Arab Republic	2245	2498	253
Yemen Democratic Republic	1835	2286	451
Southeast Asia:			
Bangladesh	1834	1934	100
India	1938	2138	200
Nepal	1957	1993	36
Pakistan	2105	2257	152
Sri Lanka	2118	2526	408
Asia and Pacific Islands:			
Burma	2124	2602	478
Fiji	2446	2914	468
Indonesia	2126	2348	222
Laos	1964	2630	666
Malaysia	2531	2777	246
Papau New Guinea	2161	2234	73
Philippines	1997	2183	186
Singapore	2667	2863	176
Thailand	2232	2354	122
Vietnam	1982	2223	241
Hong Kong	2618	2836	218
Republic of Korea	2787	2858	71

Table 2. Descriptive statistics of the dependent variables

Variables	Minimum	Maximum	Mean	Standard deviation
Dependent:				
Calorie intake, 1985	1,267	3,538	2,464.8	430.1
Calorie change, 1975-1985	-362	+908	+169.1	25.0
Independent:				
Average percentage of population growth, 1980-1985	0.0	6.2	2.7	0.9
Number of tractors per 1,000 agricultural workers, 1985	0	308	21.5	49.2
Gross national product per capita, 1985 (\$)	110	19,560	1,567.3	2,888.9
Political stability, 1986	1	7	4.7	1.8
External capital per capita, 1985 (\$)	0.0	492	24	54.0
Physical quality of life index, 1986	16	95	56.9	21.8
Years of foreign rule, 1800-1985	0.0	179	73.1	53.4
External debt per capita, 1985 (\$)	0.0	40,445.0	1,314.9	4,688.1

To illustrate to what extent internal and external factors contributed to food shortages during a decade in developing countries, change in calorie intake will be used as an empirical measure during the period 1975 through 1985. Calorie change is calorie intake in 1975 subtracted from calorie intake in 1985. In 17 countries, calorie intake was lower in 1985 than in 1975. Decreases in five countries were less than 100 calories per day, although six declined by at least 200. Thirty-seven countries had increases in intake of less than 200 calories. The remaining 35 reported intakes at least 200 calories higher in 1985 than in 1975. Gabon had the greatest decline in calorie intake (-362), and Malawi had the greatest increase (+ 908); the mean change was +169.1.

Independent Variables

The independent variables used in this study include population growth, foreign economic control per capita, gross national product (GNP) per capita, political stability, colonization, poverty, agricultural practices, and foreign investment per capita.

Population growth

The United States is one of the richest countries in the world with only 26 people per square kilometer, while Bangladesh, which is considered one of the poorest countries, has 657 people per square kilometer. For some writers, though population growth may be a future problem, today's population growth is not the cause of hunger (Lappe and Collins 1977). Others believe that the increase in population today has outstripped the productive capacity for most developing countries (Kotter 1977). In general, however, the relevant

literature considers population growth to be a problem to be solved in order to eliminate hunger.

Data for population growth for most of the developing countries in this study have been obtained from World Development Report, 1987 (World Bank 1988). The data for two countries came from World Agricultural Trends and Indicators, 1970-1988 (U. S. Department of Agriculture 1989) (Fiji, Comoros). In this study, population growth is measured by the percentage of annual growth of population of a country between 1980-1985 (Tables 2, 3). Sixteen developing countries recorded minimal population growth (0.0 percent-1.9 percent). On the other hand, there were 32 countries that showed a marked increase in annual growth (3.0 percent or more) with United Arab Emirates (UAE) having the highest growth in population (6.2 percent). The average growth rate for the developing countries from 1980-1985 was 2.7 percent. Stated with the empirical variables, the hypothesis is that the higher the percentage of annual population growth from 1980-1985, the lower the calorie intake in 1985 and the lower the change in calorie intake from 1975 to 1985.

Agricultural practices.

Use of modern agricultural methods, such as purchased fertilizers and machines, are new in most of the developing countries, especially in Africa. In many countries, utilization of these methods was confined to plantations and cash crops (Grigg 1985). Adoption of new agricultural methods was delayed mostly for economic causes.

Data for agricultural practices come from the World Agricultural Trends and Indicators, 1970-1988 (U.S. Department of Agriculture 1989). In this study, agricultural

Table 3. Independent variables by developing countries

Country	Annual population growth	Number of tractors per 1,000 agricultural workers	GNP per capita (\$)	Political stability	Physical quality of life index	External capital per capita (\$)	Colonization (years)	External debt per capita (\$)
Central America								
Belize	1.7	78	1,120	1	89	102	174	734
Costa Rica	2.7	22	1,310	1	91	89	21	1,789
El Salvador	1.0	4	820	4	69	61	21	386
Guatemala	2.9	3	1,020	6	60	8	23	489
Honduras	3.5	4	720	4	63	46	38	667
Mexico	2.6	22	2,100	3	80	53	10	1,597
Nicaragua	3.4	6	770	5	71	21	38	1,760
Panama	2.2	27	340	4	88	20	103	19,187
Cuba	1.0	108	1,534	6	95	00	102	1,228
Guadeloupe	0.5	87	3,630	3	88	492	179	128
Haiti	1.8	0	310	6	43	17	4	135
Jamaica	1.6	20	910	2	91	66	162	1,986
South America								
Argentina	1.6	152	2,120	2	89	1	0	1,848
Bolivia	2.8	1	490	4	53	21	0	679
Brazil	2.3	52	1,660	4	74	1	0	885
Chile	1.7	52	1,440	6	85	4	18	2,191
Colombia	1.9	17	1,320	2	77	1	30	524
Ecuador	2.9	6	1,160	2	73	8	30	935
Paraguay	3.3	17	890	5	80	7	11	566
Peru	2.3	9	1,010	2	69	15	21	759
Uruguay	0.7	275	1,670	3	90	2	28	1,465
Venezuela	2.9	54	3,080	1	83	1	29	2,278

Table 3 (continued)

Country	Annual population growth	Number of tractors per 1,000 agricultural workers	GNP per capita (\$)	Political stability	Physical quality of life index	External capital per capita (\$)	Colonization (years)	External debt per capita (\$)
Sub-Saharan Africa								
Angola	2.7	3	1,050	7	21	8	175	500
Benin	3.1	0	260	6	38	12	66	227
Botswana	3.5	1	810	2	48	54	81	311
Burkina Faso	2.8	0	150	6	20	16	70	88
Burundi	2.7	3	230	7	35	16	77	96
Cameroon	3.2	13	820	6	47	13	77	309
Comoros	3.1	0	292	5	37	45	134	331
Congo	3.1	29	1,110	7	57	25	50	1,909
Cote d'Ivoire	3.8	7	650	6	40	11	117	980
Ethiopia	2.5	25	110	7	31	10	0	46
Gabon	3.5	27	3,700	6	35	52	71	1,320
The Gambia	2.9	26	230	2	16	45	149	426
Ghana	3.3	8	370	5	48	7	56	179
Guinea	2.4	64	289	5	25	9	60	202
Kenya	4.1	308	290	5	56	16	163	222
Lesotho	2.7	1	470	5	52	43	98	109
Liberia	3.4	11	470	6	41	29	25	5,051
Madagascar	3.2	1	1,510	6	51	10	120	261
Malawi	3.1	36	170	6	29	8	94	146
Mali	2.3	42	150	7	27	31	79	184
Mauritius	1.3	61	1,100	2	81	22	168	623
Niger	3.0	1	230	7	27	31	59	215
Nigeria	3.3	2	820	5	41	00	111	221
Senegal	2.9	4	370	4	23	29	160	443
Sierra Leone	2.2	1	350	5	26	8	161	196

Table 3 (continued)

Country	Annual population growth	Number of tractors per 1,000 agricultural workers	GNP per capita (\$)	Political stability	Physical quality of life index	External capital per capita (\$)	Colonization (years)	External debt per capita (\$)
Sub-Sahara Africa (continued)								
Somalia	2.9	2	331	7	17	22	85	358
Tanzania	3.5	8	280	6	61	17	77	183
Togo	3.3	0	230	7	37	18	76	324
Uganda	3.0	6	370	5	49	3	74	76
Zaire	3.0	0	170	6	51	7	82	200
Zambia	3.5	0	410	6	48	32	73	704
Zimbabwe	3.7	0	680	3	64	24	87	263
North Africa and Middle East								
Algeria	3.3	4	2,570	6	50	7	132	990
Egypt	2.8	1	660	5	57	34	122	715
Iran	2.9	0	3,850	5	57	00	0	116
Iraq	3.6	4	2,630	7	51	1	132	730
Jordan	3.7	0	1,560	6	71	27	25	1,363
Kuwait	4.5	2	14,870	6	78	2	62	00
Lebanon	0	0	990	4	77	14	24	716
Libya	3.9	2	7,170	6	57	0.9	39	95
Mauritania	2.1	3	420	7	30	56	60	851
Morocco	2.5	1	560	4	49	14	44	743
Saudi Arabia	4.2	1	8,620	6	45	1	0	00
Syria	3.6	1	1,560	5	71	1	26	387
Tunisia	2.3	0	119	6	65	17	75	802
Turkey	2.5	3	1,080	5	67	3	0	554

Table 3 (continued)

Country	Annual population growth	Number of tractors per 1,000 agricultural workers	GNP per capita (\$)	Political stability	Physical quality of life index	External capital per capita (\$)	Colonization (years)	External debt per capita (\$)
North Africa and Middle East (continued)								
United Arab Emirates	6.2	0	19,560	5	69	1	0	00
Yemen Arab Republic	2.5	1	550	6	28	14	0	347
Yemen Democratic Republic	2.6	4	530	7	38	5	85	731
Southeast Asia								
Bangladesh	2.6	0	150	3	32	6	171	70
India	2.2	4	270	2	46	1	90	52
Nepal	2.4	0	160	3	30	7	0	38
Pakistan	3.1	12	340	5	39	4	90	145
Sri Lanka	1.4	9	380	2	85	21	148	246
Asia and Pacific Islands								
Burma	2.0	1	190	7	59	7	51	106
Fiji	2.0	53	1,710	2	86	38	96	685
Indonesia	2.1	0	530	5	58	3	145	266
Laos	2.0	1	122	7	39	4	56	229
Malaysia	2.5	5	1,980	3	73	13	157	1,643
Papua New Guinea	2.6	1	680	2	45	71	90	760
Philippines	2.5	3	580	3	75	8	146	578
Singapore	1.2	3	7,950	5	89	8	146	40,445
Thailand	2.1	8	800	3	79	7	0	349
Vietnam	2.6	2	245	7	75	1	87	127
Hong Kong	1.4	1	6,120	1	88	3	95	1,338
Republic of Korea	1.5	2	2,160	5	86	00	35	124

practice is measured by the number of tractors used per 1,000 agricultural workers in 1985. Sixty-one countries have 9 tractors or less per 1,000 agricultural workers. This points to the fact that in the year 1985 almost three-fourth of the developing countries lacked necessary tools for effective and productive agricultural development. Countries such as Senegal, Gambia, Zaire, Bangladesh, Nepal recorded no tractors per 1,000 agricultural workers. Eleven others had more than 100 tractors per 1,000 agricultural workers. Stated with the empirical variables, the hypothesis is that the fewer the number of tractors used per 1,000 agricultural workers in 1985, the lower the calorie intake in 1985 and the lower the change in calorie intake from 1975 to 1985.

GNP per capita.

Development of a country can be measured by GNP (Jaffee 1990), which is an indicator of goods and services produced in a country. Data for the study of GNP per capita was obtained from World Agricultural Trends and Indicators, 1970-1988 (U.S. Department of Agriculture 1989). Additional data for GNP per capita were taken from Geographical Distribution of Financial Flows To Developing Countries, 1982/1985 (Guadeloupe, Brazil, Madagascar, Uganda, Iran, Iraq, Yemen Democratic Republic), The Encyclopedia of the Third World (Kurian 1987) (Cuba), World Economic Data (Albert 1987) (Vietnam), World Market-Encyclopedia of the Nations (Sachs 1988) (Lebanon), and Countries of the World and Their Leaders Yearbook, 1993 (Guadeloupe).

In this study, economic growth of all countries is measured by the total value of gross national product per capita in a given country in 1985. The data on GNP again demonstrate a wide range. Ethiopia constitutes the low end of the scale with a GNP per

capita of \$110 for 1985, while United Arab Emirates (UAE) stands at the high end (\$19,560). In fact, the data for GNP in the three Gulf countries (Kuwait, Saudi Arabia, and United Arab Emirates) indicated high values (\$14,870, \$8,620, and \$19,560, respectively) thus corresponding closely with the data for external debt (\$0) in the same countries. Stated with the empirical variables, the hypothesis is that the lower the gross national product per capita in 1985, the lower the calorie intake in 1985 and the lower the change in calorie intake from 1975 to 1985.

Political stability.

Political instability in many developing countries was considered to be a major obstacle to their growth. In this study, countries where citizens enjoy political rights and have an authentic electoral procedure are considered more stable than countries that do not permit any legal opposition or open elections. Political instability is measured in 1986 by political rights rankings according to The Encyclopedia of the Third World, 1986 (Kurian 1987:xvii).

These rankings are developed by Freedom House of New York and they have been issued annually since 1972. Freedom, in the context of these rankings, does not mean national sovereignty, but rather the extent to which the people of a country are able to play an active role in choosing their leaders and in determining the laws and means of enforcement under which they will live. States ranked 1 in political rights have an authentic electoral procedure, multiple parties, free elections, and de facto political participation by all segments of society. States ranked 2 have the same free political system but with higher illiteracy, poverty, and violence. States ranked 3 and 4 are characterized by unfair electoral systems including banning of opposition parties. States ranked 5 have poor electoral procedures but with significant legal opposition. States ranked 6 have electoral systems that are manipulated by the ruling parties. States ranked 7 do not permit any legal opposition or open elections.

Fourteen countries had political systems in which people were able to play an active role in choosing their leaders. Another 17 had unfair electoral systems including banning of opposition parties. The remaining 58 had political systems that were manipulated by the ruling parties and had poor electoral procedures that did not permit any legal opposition or open elections. Stated with the empirical variables, the hypothesis is that the higher the numerical rank of political rights in 1986, the lower the calorie intake in 1985 and the lower the change in calorie intake from 1975 to 1985.

Poverty.

Poor countries are said to be caught in a vicious circle of poverty. Poverty in poor countries does not permit savings or capital accumulation. As a consequence, investment is not possible. Lack of investment leads to low production which causes shortages of many products, including food. The majority of rural people in many developing countries suffer from lack of money and policies that deprive them of many social services. Poverty can also be explained by the lack of basic social services affecting life expectancy, infant mortality, and literacy. In this study poverty is measured by the Physical Quality of Life Index (PQLI) according to The Encyclopedia of the Third World, 1986 (Kurian 1987:xvi).

This index has been developed by Overseas Development Council, Washington, D.C. It covers 160 countries on a scale from 1 to 100. The PQLI is designed as a measure of a country's general progress toward meeting the basic human requirements for a majority of its population. It is a consolidated composite index of three indicators: life expectancy, infant mortality and literacy, giving equal weight to each of the three indicators. The PQLI's advantage is that it is not tied to monetary growth and thus reflects the degree to which the entire population receives the benefits of progress.

PLQI is a good indicator of the theoretical concept of poverty because it includes indicators such as literacy, life expectancy, and infant mortality, which reflect more than one aspect of the quality of human life in developing countries. It is believed that improvements in these indicators are important for the development process. Measurements that use income may be seriously inaccurate (Todaro 1989; Fields 1984).

Based on the data collected, thirty of the developing countries scored low on the PQLI (less than a score of 45), which indicates that the majority of the population in these countries did not benefit much from the development of their nations. About a quarter of the developing countries had relatively high rankings (75-95), which indicates that more residents in this last group benefitted from progress in their nations than did those living in countries with lower scores. Stated with the empirical variables, the hypothesis is that the lower the physical quality of life index in 1986, the lower the calorie intake in 1985 and the lower the change in calorie intake from 1975-1985.

Foreign investment.

The data for the foreign investment variable were available in Geographical Distribution of Financial Flows to Developing Countries, 1982/1985 and 1969/1975 and the U.N. statistical Yearbook, 1985/1986 (United Nations 1987) (Guadeloupe, Venezuela, Kuwait, Libya, Saudi Arabia, United Arab Emirates). Foreign investment was measured by the value of external capital per capita in a country in 1985. This measure has been used by a number of researchers (Bornschiefer and Chase-Dunn 1985; London and Williams 1988) as a variable affecting dependency in developing countries. Among these 89 countries, the majority (68%) demonstrated a strong dependency on external capital by

encouraging relatively higher rates of external investment into their countries. Thirty-four countries of this group scored between \$5.00 and \$19.99; and 30 had \$20.00 or more. Guadeloupe recorded the highest external capital per capita (\$492), while three Gulf countries had no external capital during the study period; this may be because of their strong economies. Stated with the empirical variables, the hypothesis is that the higher the value of external capital per capita in 1985, the lower the calorie intake in 1985 and the lower the change in calorie intake from 1975 to 1985.

Colonization.

The majority of the developing countries witnessed the imposition of some form of direct political and economic control by Western countries. In many cases, colonial powers controlled and exploited the national resources of the developing countries. In some cases, the process of colonial agrarian transformation, motivated by political and economic objectives, continued in both colonial and post-colonial states (Heffernan and Sutton 1991). Data for colonization were attained through The Encyclopedia of the Third World (Kurian 1987).

In this study, colonization was measured by the number of years from 1800 through 1985 during which a country has been under foreign rule. Among these 89 countries, the majority (78 countries) had been colonized for at least some period. Guadeloupe had been colonized for the longest time (179 years). Thirty-three have been under foreign rule between 50 and 99 years, while 24 have been colonized for 100 years or more. The mean was 73.1 years, indicating that colonization is a reality in the history of developing countries. Stated with the empirical variables, the hypothesis is that the

greater the years of colonization from 1800 through 1985, the lower the calorie intake in 1985 and the lower the change in calorie intake from 1975 to 1985.

Foreign economic control

In many developing countries, foreign economic control by external debt imposes severe constraints on economic growth. External debt has a maturity of more than one year, is owed to nonresidents, and is repayable in foreign currency, goods, or services (World Bank 1984). For the majority of the developing countries, interest payments of external debt became a devastating drain on revenue from export and savings (Parfitt and Riley 1989).

Data for foreign economic control were provided by Debt Survey of Developing Countries, 1988 (Strack and Siegfried 1990), World Agricultural Trends and Indicators, 1970-1988 (U.S. Department of Agriculture 1989) (Tanzania, Iran, Iraq), U.N. Statistical Yearbook, 1985/1986 (United Nations 1987) (Guinea, Lesotho), The Global Debt Crisis: Forecasting for the Future (MacDonald et al. 1990) (Libya, Laos, Angola, Cuba), Geographical Distribution of Financial Flows To Developing Countries, 1982/1985 (Yemen Democratic Republic), and Countries of the World and Their Leaders Yearbook, 1993 (Guadeloupe). Despite numerous sources of data for foreign economic control, no data were available for countries such as Saudi Arabia, Kuwait, and the United Arab Emirates (UAE). It was assumed that due to their strong economies these countries had no external debt during the study period. They were thus given codes of zero on this variable.

External debt is measured by the total dollar value of the external debt per capita of a country in 1985. This variable varies greatly among the developing countries. On one hand, there were countries with no external debt (Kuwait, Saudi Arabia, United Arab Emirates (UAE)). On the other hand, there were countries such as Singapore with external debts per capita as high as \$40,445. The average external debt per capita for these countries in 1985 was \$1,315. Stated with the empirical variables, the hypothesis is that the higher the value of external debt in 1985, the lower the calorie intake in 1985 and the lower the change in calorie intake from 1975 to 1985.

Problems of Validity and Reliability of the Data

As is seen from the description of the data, all of the information used in this study are secondary. They have been attained through various international and regional sources. Such sources, in the developing countries, sometimes do not reflect the actual picture. Putting together information from different sources may affect relationships between variables in the data set. According to the World Development Report, 1990 (World Bank 1991), estimates based on the current prevailing situations in the area are sometimes necessary because information is not available from other sources. In addition, there are countries that report relatively high or low figures to gain political or international support. This brings to the forefront the question of their validity and reliability.

Validity has been defined as the ability of the research instrument to measure what it is attempting to measure. Reliability is the consistency of measurement - the degree of

accuracy a research instrument to measure what it is attempting to measure. Both concepts are important to researchers; while reliability concerns a particular property of empirical indicators, validity focuses on the relationship between concept and indicator (Sproul 1988).

Most of the measures used in this research have been used widely by researchers and have resulted in some frequently-cited studies (Wimberley 1990, 1991; Bornschieer and Chase-Dunn 1985; Chase-Dunn 1975). In fact, the variables discussed in this chapter have helped sociologists predict the influence of developed countries on developing countries far more precisely than international economic theories or sociological modernization theories. Thus, the measures used in this research can be considered to be valid measurements for the study of the causes of food shortage in the developing countries.

With regard to the reliability of the data, the usual problems associated with secondary data can be noted. Some scholars believe that one of the main sources of data errors are in the actual data gathering stage (Bailey 1982). However, in this study, almost all of the sources base their data on well-established institutions such as the United Nations, the World Bank, or regional sources. This enhances the value of the information although the degree of reliability remains an issue in need of additional study.

Methods of Data Analysis

Three statistical methods—cross-tabulations, Pearson's product-moment correlations, and regressions—are used. Cross-classification tables are considered as some

of the most useful tools for data analysis (Noursis 1988). They are used here because it is convenient to interpret and examine the percentage summary shown in contingency tables to assess whether there are associations between calorie intake and change (the dependent variables) and the independent variables. Contingency tables reflect joint classification of dependent and independent variables by giving percentages for each joint classification (Sproull 1988). The chi-square test is used to determine whether these relations are statistically significant.

Pearson's correlation coefficient (r) is an indicator for the strength of linear association between variables (Noursis 1988; Sproull 1988). Correlation coefficients are used to analyze the strength of the relationship between individual independent variables and calorie intake and change in developing countries. Values of the coefficient may range from -1, when the linear relationship is perfectly negative, to +1, when the linear relationship is perfectly positive, with a value of 0 indicating no linear relationship between the variables.

Finally, regression is used to determine the specific function relating two or more variables. The previous two methods test the relationships between calorie intake and change and individual independent variables. Multiple regression is used because it summarizes the linear relationship between a single dependent variable (calorie intake or change) and a set of independent variables. The results help decide which of the independent variables are most strongly related to the dependent variables. Furthermore, log transformation was used to reduce skewness problems in four independent variables—number of tractors, gross national product, external capital, and external debt.

IV. FINDINGS

Contingency Tables

Statistically significant associations occur between calorie intake and four independent variables (number of tractors, GNP, physical quality of life index, external debt) when crosstabulations are examined (Table 4). All of these variables are in the directions of the hypotheses except for external debt. For example, only 16% of the developing countries with relatively low numbers of tractors per 1,000 agricultural workers have relatively high calorie intake per person per day; 61% of the countries with high numbers of tractors also have high calorie intake. The results for GNP indicate a similar statistically significant relationship. Sixty-one percent of countries with low GNP have low calorie intake per person per day, whereas none of the countries with high GNP per capita are low on calorie intake. On the physical quality life index (PQLI), almost 57% of the countries with low physical quality of life have low calorie intake per person per day, and only 10% have high calorie levels. Nearly half of the countries with low or medium external debt show low calorie intake, while almost half of those with high external debt have high calorie intake; this relationship is statistically significant and in the opposite direction of the predicted hypothesis.

The number of tractors, GNP, and physical quality of life index are related to calorie intake in the directions of the hypotheses and have a direct effect on the amount of calorie intake per person per day in developing countries. On the other hand, no statistically significant association is observed between calorie intake and the remaining four independent variables—political stability, population growth, external capital, and

Table 4. Calorie intake by independent variables

Independent variables	Calorie intake			Totals	
	Low (<2,249)	Medium (2,250-2,599)	High (2,600>)	Percentage	Frequency
Population growth					
Low (<2.4%)	22.6	38.7	38.7	100.0	31
Medium (2.5%-2.9%)	46.2	26.9	26.9	100.0	26
High (3.9%>)	31.3	37.5	31.3	100.0	32
Totals	32.6	34.8	32.6	100.0	89
Chi-square = 3.74; p = 0.443					
Number of tractors per 1,000 agricultural workers					
Low (<1)	53.1	31.3	15.6	100.0	32
Medium (2-9)	37.9	37.9	24.1	99.9	29
High (3>)	3.6	35.7	60.7	100.0	28
Totals	32.6	34.8	32.6	100.0	89
Chi-square = 22.09; p = 0.001					
Gross national product					
Low (<\$399)	61.3	25.8	12.9	100.0	31
Medium (\$400-\$1,199)	31.3	53.1	15.6	100.0	32
High (\$1,200>)	0.0	23.1	76.9	100.0	26
Totals	32.6	34.8	32.6	100.0	89
Chi-square = 43.36; p = 0.001					
Political stability					
Low (6>)	36.1	33.3	30.6	100.0	36
Medium (4-5)	25.0	42.9	32.1	100.0	28
High (3<)	36.0	28.0	36.0	100.0	25
Totals	32.6	34.8	32.6	100.0	89
Chi-square = 1.73; p = 0.784					
Physical quality of life index					
Low (45<)	56.7	33.3	10.0	100.0	30
Medium (46-69)	31.0	34.5	34.5	100.0	29
High (70>)	10.0	36.7	53.3	100.0	30
Totals	32.6	34.8	32.6	100.0	89
Chi-square = 21.87; p = 0.001					

Table 4. (continued)

Independent variables	Calorie intake			Totals	
	Low (<2,249)	Medium (2,250-2,599)	High (2,600>)	Percentage	Frequency
External capital					
Low (\$<4.99)	15.4	34.6	50.0	100.0	26
Medium (\$5.0-\$19.99)	44.1	32.4	23.5	100.0	34
High (\$20>)	34.5	37.9	27.6	100.0	29
Totals	32.6	34.8	32.6	100.0	89
Chi-square = 7.42; p = 0.115					
Colonization					
Low (<49 years)	21.9	37.5	40.6	100.0	32
Medium (50-99 years)	48.5	27.3	24.2	100.0	33
High (100>)	25.0	41.7	33.3	100.0	24
Totals	32.6	34.8	32.6	100.0	89
Chi-square = 6.38; p = 0.172					
External debt					
Low (<\$199)	47.6	23.8	28.6	100.0	21
Medium (\$200-\$499)	50.0	38.5	11.5	100.0	26
High (\$500>)	14.3	38.1	47.6	100.0	42
Totals	32.6	34.8	32.6	100.0	89
Chi-square = 15.70; p = 0.003					

colonization (Table 4). Although not significant, three of these variables relate to calorie intake in the directions of the hypotheses. Almost 39% with low population growth (<2.4%) have high calorie intake per person per day. Countries with high population growth (3%>) demonstrated equal distribution (31%) in low as well as in high calorie intake. Almost one-half of the countries with 50-99 years of colonization have low calorie intake, while those with fewer or more years of colonization tend to have medium or high calorie intake. Although half of the developing countries with low external capital have high levels of calorie intake per person per day, at least a third with medium or high external capital scored low on calorie intake. Finally, there is little difference on calorie intake among the three levels of political stability; if anything, the relationship is slightly the reverse of that predicted.

No statistically significant associations are observed between calorie change between 1975 and 1985 and the independent variables (Table 5). Five of the independent variables are related to calorie change are in the predicted directions, two variables (political stability, colonization) are in the opposite directions of the hypotheses, and external debt has little relationship to calorie change.

About three-quarters of the countries with high political stability have relatively low or medium calorie change, while two-thirds of those with low stability had medium or high change on the measure of calories. On colonization, about two-thirds of the countries with few years of colonization have low or medium calorie change, while 85 percent of these with high years of colonization have medium or high calorie change. Finally, there is an association significant at the 0.10 level between gross national product per capita (GNP) and

Table 5. Calorie change by independent variables

Independent variables	Calorie change			Totals	
	Low (74<)	Medium (75-199)	High (200>)	Percentage	Frequency
Population growth					
Low (<2.4%)	25.8	32.3	41.9	100.0	31
Medium (2.5%-2.9%)	26.9	38.5	34.6	100.0	26
High (3.0%>)	40.6	34.4	25.0	100.0	32
Totals	31.5	34.8	33.7	100.0	89
Chi-square = 2.85; p = 0.584					
Number of tractors per 1,000 agricultural workers					
Low (<9)	34.4	40.6	25.0	100.0	32
Medium (10-29)	41.4	27.6	31.0	100.0	29
High (30>)	17.9	35.7	46.4	100.0	28
Totals	31.5	34.8	33.7	100.0	89
Chi-square = 7.52; p = 0.238					
Gross national product					
Low (<\$399)	35.5	38.7	25.8	100.0	31
Medium (\$400-\$1,199)	25.0	46.9	28.1	100.0	32
High (\$1,200>)	34.6	15.4	50.0	100.0	26
Totals	31.5	34.8	33.7	100.0	89
Chi-square = 7.87; p = 0.096					
Political stability					
Low (6>)	30.6	25.0	44.4	100.0	36
Medium (4-5)	32.1	39.3	28.6	100.0	28
High (3<)	32.0	44.0	24.0	100.0	25
Totals	31.5	34.8	33.7	100.0	89
Chi-square = 3.92; p = 0.416					
Physical quality of life index					
Low (45<)	33.3	40.0	26.7	100.0	30
Medium (46-69)	41.4	24.1	34.5	100.0	29
High (70>)	20.0	40.0	40.0	100.0	30
Totals	31.5	34.8	33.7	100.0	89
Chi-square = 4.40; p = 0.354					

Table 5. (continued)

Independent variables	Calorie change			Totals	
	Low (74<)	Medium (75-199)	High (200>)	Percentage	Frequency
External capital					
Low (<\$4.99)	34.6	23.1	42.3	100.0	26
Medium (\$5.00-\$19.99)	32.4	41.2	26.5	100.0	34
High (\$20>)	27.6	37.9	34.5	100.0	29
Totals	31.5	34.8	33.7	100.0	89
Chi-square = 2.84; p = 0.585					
Colonization					
Low (<49 years)	35.5	35.5	29.0	100.0	31
Medium (50-99 years)	43.3	23.3	33.3	99.0	30
High (100>)	14.3	46.4	39.3	100.0	28
Totals	31.5	34.8	33.7	100.0	89
Chi-square = 6.81; p = 0.146					
External debt					
Low (<\$199)	33.3	33.3	33.3	99.9	21
Medium (\$200-\$499)	34.6	30.8	34.6	100.0	26
High (\$500>)	28.6	38.1	33.3	100.0	42
Totals	31.5	34.8	33.7	100.0	89
Chi-square = 0.49; p = 0.974					

calorie change. Nearly 75% of the countries with low GNP have low or medium calorie change, while half of the countries with high GNP have high levels of calorie change.

Zero-Order Correlational Analysis

Consistent with the direction of the hypotheses, calorie intake per person per day is positively correlated at statistically significant levels with number of tractors, GNP, and the physical quality of life index (Table 6). Also consistent with the direction of the hypothesis, calorie intake per person per day is negatively correlated with external capital. Calorie intake per person per day is negatively correlated with political stability and colonization as predicted, although statistical significance is not achieved at the 0.05 level. Contrary to predictions, calorie intake is positively correlated with population growth and external debt; these results are not statistically significant, however.

Unlike calorie intake per day per person, there are no statistically significant correlations at the 0.05 level between calorie change and the independent variables (Table 7). Consistent with the direction of the hypotheses, calorie change is weakly correlated in a positive direction with three variables (number of tractors, GNP, PQLI). Also consistent with the direction of the predicted hypothesis, calorie change is negatively correlated with population growth, external capital, and external debt. Calorie change is weakly and positively correlated with political stability and colonization, which is not the direction predicted.

Table 6. Correlation between calorie intake and independent variables

Independent variables	1	2	3	4	5	6	7	8	9
1 Calorie intake	1.00	0.02	0.57***	0.61***	-0.08	0.52***	-0.23*	-0.12	0.12
2 Population growth		1.00	-0.27*	0.12	0.32**	-0.35**	-0.12	-0.12	-0.41***
3 Number of tractors			1.00	0.50***	-0.33**	0.68***	-0.13	-0.16	0.38***
4 Gross national product				1.00	-0.23*	0.55***	-0.25*	-0.13	0.02
5 Political stability					1.00	-0.50***	-0.15	-0.10	-0.22*
6 Physical quality of life index						1.00	-0.10	-0.10	0.32**
7 External capital							1.00	0.25*	0.27**
8 Colonization								1.00	0.14
9 External debt									1.00

* p < 0.05

** p < 0.01

*** p < 0.001

Table 7. Correlation between calorie change and independent variables

Independent variables	1	2	3	4	5	6	7	8	9
1 Calorie change	1.00	-0.06	0.16	0.05	0.12	0.12	-0.06	0.04	-0.04
2 Population growth		1.00	-0.27*	0.12	0.32**	-0.35**	-0.12	-0.12	-0.41***
3 Number of tractors			1.00	0.50***	-0.33**	0.68***	-0.13	-0.16	0.38***
4 Gross national product				1.00	-0.23*	0.55***	-0.25*	-0.13	0.02
5 Political stability					1.00	-0.50***	-0.15	-0.10	-0.22*
6 Physical quality of life index						1.00	-0.10	-0.10	0.32**
7 External capital							1.00	0.25*	0.27**
8 Colonization								1.00	0.14
9 External debt									1.00

*P< 0.05

**P< 0.01

*** p < 0.001

Multiple Regression Analysis

Some of the independent variables are significantly correlated (Table 6). For example, population growth is negatively related to three variables (number of tractors, PQLI, external debt). When population growth is high, number of tractors, quality of life, and foreign dependency are lower in developing countries. However, when population growth is high, political stability also is high. The number of tractors is positively correlated with three variables: GNP, PQLI, and external debt. The number of tractors is high when GNP, quality of life, and external aid in a country are high. But number of tractors is negatively related to political stability; politically stable countries have fewer tractors per 1,000 agricultural workers. Gross national product is correlated positively with PQLI and negatively with political stability and external capital. Gross national product is higher in countries where the quality of life is relatively high. However, GNP is low where there is relatively low political stability and high penetration of foreign aid. Foreign aid has positive effects on colonization and foreign dependency. Countries with more years of colonization and that are heavily indebted have high penetration levels of external capital.

Relatively few correlations of 0.50 or higher occur among the independent variables — PQLI with number of tractors (0.68), GNP (0.55), and political stability (0.50), and number of tractors with GNP (0.50). These results indicate the absence of serious multicollinearity problems that may result in unstable regression coefficients (Norusis 1986). Accordingly, multiple regression can be used for additional statistical analysis among the variables. Multiple regression examines the effect of each of the independent

variables in this study while controlling for the effects of all others. In addition, multiple regression indicates the effects of the set of the independent variables combined (Hedderston 1987).

Regression results indicate that calorie intake per person per day has statistically significant associations with three variables when others are controlled — number of tractors, gross national product, and political stability (Table 8). Two of these relationships are in the directions predicted, with GNP (0.35) having the highest standardized regression coefficient and number of tractors used (0.33) the second highest. Political stability, on the other hand, is related to calorie intake in the direction opposite that predicted. It has the lowest regression coefficient (0.20) among the three variables. The remaining five independent variables (physical quality of life index, external capital, external debt, population growth, colonization) are not related to calorie intake at statistically significant levels; the first three are related in the direction of the hypotheses and the last two are not. About half of the variance in calorie intake is explained by the independent variables.

Political stability, with a regression coefficient of 0.27, is the only variable significantly related to calorie change between 1975 and 1985 when all are entered (Table 9). This relationship is in the opposite direction of the predicted hypothesis, which indicates that political stability does not contribute to an increase in calorie intake in developing countries. Instead, political instability contributes to an increase of calorie intake. Of the remaining variables, none of which reach statistical significance, four (population growth, number of tractors, physical quality of life index, external debt) are related in the direction predicted. Three (gross national product, external capital, colonization) yield results in the direction

Table 8. Relationships between calorie intake and independent variables

Independent variables	b	B
Population growth	39.56	0.08
Number of tractors used	92.79	0.33**
Gross national product	132.65	0.35**
Political stability	47.10	0.20*
Physical quality of life index	4.77	0.24
External capital	-15.69	-0.04
Colonization	0.40	0.05
External debt	-2.90	-0.01
R Square = 0.52		
Adjusted R Square = 0.47		
F = 10.63***		

*p < 0.05

**p < 0.01

Table 9. Relationships between calorie change and the independent variables

Independent variables	b	B
Population growth	-18.90	-0.07
Number of tractors used	40.10	0.24
Gross national product	-15.27	-0.07
Political stability	38.33	0.27*
Physical quality of life index	2.04	0.18
External capital	5.15	0.03
Colonization	0.59	0.13
External debt	-28.77	-0.18
R Square = 0.11		
Adjusted R Square = 0.02		
F = 1.19		

*p < 0.05

predicted. Three (gross national product, external capital, colonization) yield results in the direction opposite that predicted. Little variance in calorie change is explained by the independent variables.

V. CONCLUSIONS AND RECOMMENDATIONS

Summary of Findings

This section addresses the research questions raised in previous chapters. To what extent do internal and external factors affect food shortages, as measured by calorie intake and change, in developing countries?

Calorie intake is significantly correlated with four independent variables — number of tractors, gross national product (GNP), physical quality of life (PQLI), and external capital; all are related in the direction predicted. In developing countries, calorie intake increases with the increase of number of tractors per 1,000 agricultural workers, and people have higher levels of calorie intake if the GNP per capita is relatively high. Good quality of life in developing countries predicts high consumption of calories; finally, calorie intake is lower in countries where foreign aid is relatively high.

However, in a regression analysis, calorie intake is affected by only two independent variables in the direction predicted and by one variable in the direction opposite to that expected. Calorie intake is higher in countries where number of tractors per 1,000 agricultural workers is relatively high. That more tractors used will increase calorie consumption is not surprising. Mechanization is considered one of the major sources that can increase farm yields (Todaro 1989). Developing countries need capital to obtain such equipment. Also, GNP enables people to consume relatively high amounts of calories in developing countries. Relatively high GNP may enable farmers to innovate farming systems by using modern sources to increase farm yields. Quality of life and

external investment fail to reach statistical significance in the regression analysis and another variable (political stability) was significant but in the direction opposite to that predicted. Politically stable countries have somewhat lower calorie intake when other variables are included.

It has been argued by political economists that during early stages of development of a country, there should be a powerful government with authoritarian power to manage pressures of development (Coleman and Cressey 1993). This is because in the early stages of development, authoritarian power is needed to have comprehensive planning and financial discipline. The findings of this study partially support this argument, as most of countries are in early stages of development.

No statistically significant associations are observed between calorie intake and the remaining independent variables: population growth, colonization, and external debt. It was predicted that countries with relatively high levels of population growth consume less calories. The findings do not support this prediction. Instead countries with high population growth consume high amount of calories. These findings may be attributed to the fact that there was substantial change of food production increase in some developing countries, such as India and Pakistan where the Green Revolution started some years ago. This may lead to general increase in levels of calorie intake in these nations despite the fact that there was relatively rapid population growth.

As for colonization, there is no uniform effect on all countries studied. Effects of colonization vary from country to country depending on the purpose of colonization. In some countries, such as in Sudan, Ghana, and India, entire agricultural structures were

changed from food crops to cash crops to feed the colonizer's industry. British colonization frequently diverted agricultural efforts from food production to cotton production to feed the British textile industry. In other countries, the purpose was to extract precious metals and mineral resources, such as in Liberia. In Africa, colonial leaders focused on export rather on sustainable agriculture (Tanglely 1987). Thus, the years of colonization may be an insufficient indicator; some measure of the magnitude of change created by colonization would be preferred.

Finally, in relation to external debt, one of the major reasons developing countries seek foreign aid is political. Among other things, foreign aid is considered to be a tool for political leaders in developing countries to suppress opposition and maintain power. In such cases, the bulk of the assistance will go to non-developmental projects such as military and internal security. The rest of the investment will go to highly capital-intensive industries in a few urban centers, neglecting the countryside (Todaro 1989). This behavior has a negative effect on food production in these countries. In addition, more than half of the aid received by developing countries is in the form of loans rather than grants. Developing countries have to pay them back with interest. But due to heavy indebtedness for loans from previous times, very little of the foreign aid actually goes to developmental projects. For every dollar sent to developing countries as foreign aid, 87 cents goes back to donors by repaying previous loans. External debt is a direct cause of poverty and hunger in developing countries (Toton 1988; George 1988). Finally, amount of debt used in the study may not be a good measure for the indebtedness of a country. It may have been more appropriate to use other measurement, such as debt-service ratio,

which refers to the percentage of annual debt payments out of national income to measure countries' indebtedness.

Unlike the first set of hypotheses involving calorie intake per person per day, where several independent variables make significant contributions, only political stability is significantly correlated with calorie change, which is the subject of the second set of hypotheses. And it is related in a manner contrary to the direction predicted. That is, higher levels of political stability result in less calorie change in developing countries. According to neo-classical political economists, there should be strong "iron hands" in countries in developing regions despite the level of democracy (Chirot 1977). Because the negative effects of core countries and multinational corporations are so great, only relatively autocratic governments can control their influence and implement appropriate development programs. Thus, the degree of political democracy may be suppressed under such processes. Moreover, tax bases required for domestic development can be established only under such strong governments.

Regressions with calorie change failed to reach statistical significance on seven variables—population growth, number of tractors, GNP, PQLI, external capital, colonization, and external debt. With regard to population growth, colonization, external capital, and external debt, the same reasons related to level of calorie intake may be applied for calorie change as well. Although there was significant relationship between calorie intake and number of tractors, there is no relationship with calorie change. This may be attributed to the relatively short period (1975-1985) used to measure calorie change. Results may have been different if longer period of time was considered.

Gross national product (GNP), which is the combination of food and service production, is used as an indicator of standard of living. However, some studies found nonlinear relationships between GNP per capita and basic needs in developing countries (Wimberley 1990). Wimberley (1990) argued that rapid economic growth in some regions in developing countries have been accompanied by stagnation and bad living conditions for some segments of the population. Thus, GNP may not be a good predictor for basic needs such as food in some developing countries.

Study Limitations

This study faced several limitations. First, this research was intended to be a comparative study of both developing and developed countries. Because of lack of data on some items and lack of variance on others for developed nations, the study is confined to developing countries. The second shortcoming concerns data from different sources, which may produce different accuracy levels among the predictors. For example, the United Nations depends on governments and its own agencies as basic sources of their data; financial institutions such as the World Bank depend on governments and other official agencies. Other organizations gather their data from unofficial networks. Third, the compatibility of data across countries is difficult to estimate; also, data are missing from several countries. Finally, the study lacks two other factors that may be of importance. The first involves relations between developed and developing nations. Unequal distribution of economic and political power is considered to be a significant factor contributing to the stagnation of developing countries (Todaro 1989). The second is

a social-psychological effect on calorie intake within developing countries, where standards of living tend to be very low for vast segments of the population. One of the reasons for this devastating poverty is unemployment. However, these problems are eased by the strength of traditional family and community values in developing nations. Those who don't have or cannot afford food are taken care of by other members of the family, tribe, or clan. In Africa, for example, tribalism is one of these traditional institutions that gives protection and support to families and individuals in the absence of a strong state (Wiarda 1983). Households may have more people to feed than the figures reported or estimated. This behavior may influence calories consumed by households.

There are some unusual values that affected the statistical analysis of the study. Values on a few variables were unusually high (outliers), which can affect coefficients. Four variables showed skewness—number of tractors used, gross national product external capital, and external debt. Efforts to solve this involved log transformations. Finally, relatively high correlations between a few independent variables (PQLI with number of tractors, GNP, and political stability, GNP with number of tractors) are observed.

A question may be asked whether these limitations are serious enough to question the findings of this study. The data of this study were acquired through well-established and highly-reputed sources, such as the World Bank and the U.S. Department of Agriculture. Variables such as GNP, external debt, and PQLI are used in many studies. The findings should be considered tentative until they are examined in other periods and with additional indicators and measures of change, however.

Conclusions and Recommendations

Questions were raised about the extent factors such as population growth, number of tractors used, gross national product, political stability, poverty, foreign investment, colonization, and foreign economic control affect calorie intake and change in developing countries from 1975 to 1985. The general hypothesis was that dependency promotes food shortages in developing countries. Of the eight hypotheses on calorie intake in this study, only those on the effects of number of tractors and GNP are supported. These two factors can be looked at from two different perspectives. According to dependency theory, an increase in the number of tractors in developing countries is related to foreign capital penetration, which has negative impacts on these countries (Chase-Dunn 1985). The findings contradict this.

On the other hand, the modernization perspective claims that more tractors used is an example of technological change from a traditional to a modernized agricultural system; this would lead to the development of such countries (Rostow 1960). The findings support this. So, this study adds empirical support to the modernization perspective that the internal factors (number of tractors, GNP) are most important for the development of developing countries. People consume more calories in countries where more tractors are being used in farming and where GNP is relatively high.

Potential external factors from the dependency perspective, such as external capital, external debt, and colonization, are not supported. That is to say, dependency does not promote food shortages in developing countries; instead the internal factors do. However, the internal factors are affected by external factors. The number of tractors used by

multinational corporations (MNCs) can be considered to be foreign capital penetration into the developing countries. From the dependency perspective, MNCs are a good example of private investment by core countries in the periphery. Dependency theorists believe that penetration of foreign investment is harmful to the periphery. But the findings do not support this argument.

Also, the dependency school argues that core domination and penetration into developing countries damage domestic political processes that are contrary to core economic interests (Wimberley 1990). Political stability, according to the findings of this study, is statistically significant in the direction opposite that which was predicted. That is, people in politically stable countries consume fewer calories. Dependency simply means a situation by which the economy of a certain nation is conditional and dominated by the economy of another (Dos Santos 1984). Some forms of domination are colonization, foreign debt, and external capital from developed countries. Several studies support dependency theory, such as Chase-Dunn (1975), Evans and Timberlake (1980), and Borschier and Chase-Dunn (1985). For example, penetration of foreign investment creates inequality and has harmful effects on people's well-being and on food intake in peripheral nations according to Chase-Dunn (1975). The findings of this dissertation supported none of these factors, contrary to dependency theory.

Modernization theorists believe that the problem of widespread food shortages in developing countries is due to problems generated internally. Modernization theory calls for developing countries to develop by imitating and following developed countries. To eliminate underdevelopment problems, modernization recommends application of

technology. The findings support this argument in the sense that using tractors in farming systems will increase the productivity of cultivated land. According to modernization, development will occur by provision of needed capital for investment. High GNP per capita will lead to high rate of saving, which enables developing countries to generate domestic capital for development. The study supported this view as well. GNP has a significant positive effect on the amount of calories people consume in these countries.

However, to modernize agricultural systems in developing countries, more than tractors is needed. The green revolution is considered to be a modern way to increase food production. Also needed are fertilizers, pesticides, permanent irrigation systems, and large areas of fertile cultivated land. The situation in many parts of the developing countries may not be appropriate for such technological changes, however. Not only are most of these conditions expensive, but they could damage the local environment. In addition, in some areas people have poor soil and insufficient rainfall, both of which are unfavorable to the green revolution (Tangley 1987). In these special areas, precautions are recommended. The soil and the environment must be saved from exploitation. Field experience indicates that indigenous knowledge, which is considered to be the basis of agriculture, can be combined with modern methods in farming systems to achieve good results, such as the case in Burkina Faso (Ulluwishewa 1993; Tangley 1987).

Based on the findings, both developing and developed countries must come together to solve the problem of food shortages in developing countries. Rich countries can help poor ones to reform their local institutions to meet the challenge of development. This can be done by dropping some trade barriers and opening markets to the products of

developing countries. Also, reconsideration of the conditions of foreign aid and foreign debt will enable developing countries to develop economically. This may lead to modern farming systems, more food production, and increased income.

Developing countries face dilemmas because of the difficult choices they confront. How do they spend their limited resources—in industry or in agriculture? Do they depend on MNCs to develop their countries or depend on their own resources? However, developing countries are encouraged to speed up the transition from this traditional stage (first stage) to preconditions for the take-off stage (second stage), according to Rostow (1960). Developing countries bear this brutal problem; they are not required to give up their industrial projects but are requested to give food production the first priority. It is believed that rapid agricultural growth generally has been associated with overall development of countries and that no agricultural development can be achieved without applying new agricultural methods. Because the majority of developing countries lack the technology needed for this, in part because of financial burdens at this time, there is a need for cooperation between national and international institutions in areas of appropriate technology. Appropriate technology is more effective when it reaches the world's poorest areas (Schumacher 1973). Thus, it is recommended that extension and research services are needed, with the help of local indigenous knowledge systems, to modernize farming systems and to protect and help local producers increase their incomes. Local governments are encouraged to focus their attention on promoting the rural economy to lessen the effects of poverty in these areas.

Overall, this study indicates the importance of internal and external factors affecting food availability and change in developing countries. Although the results suggest that internal factors are most important, both factors have influenced the food situation in developing countries. The factors are interrelated, which makes it difficult at times to distinguish one from the other. For example, poverty is seen as an internal problem at one time and as a trap set for the developing countries at another. This can be applied to the number of tractors, external debt, and political instability as well. For better understanding and application of the internal and external factors in developing countries, more research is recommended. In addition, research is needed on the effects of external factors such as colonization, foreign economic penetration, and external debt. Also, studies should focus on other internal factors, such as population growth and poverty in developing countries, as they frustrate efforts to solve problems. Finally, research in food production in some developing areas such as Africa started only relatively recently (Norman 1985). Thus, African nations, in particular, must undertake more active research on food value of local plants.

Most factors creating global food problems are the result of human decisions; thus, it should not be impossible to come up with solutions. Sincere efforts to assist disadvantaged people around the world are needed. According to the Universal Declaration of Human Rights, food is a basic need for all human beings. Thus, it becomes a duty for the international community to insure that an adequate system for monitoring the right to food is developed and put into action.

REFERENCES

- Abbott, John
1992 Policies and Poverty: A Critique of the Food and Agriculture Organization. New York: Routledge.
- Alamgir, Mohiuddin, and Poonam Arora
1991 Providing Food Security For All. New York: International Fund for Agricultural Development.
- Albert, Cecelia (ed.)
1987 World Economic Data. Santa Barbara, CA: ABC-CLIO.
- Amin, Samir
1974 Accumulation on World Scale. New York: Monthly Review Press.
- Bailey, Kenneth
1982 Methods of Social Research. New York: Free Press.
- Barraclough, Solon
1991 An End to Hunger? The Social Origins of Food Strategies. London: Zed Books.
- Biswas, Margaret, and Asit Biswas
1979 Food, Climate, and Man. New York: Wiley.
- Blomstrom, Magnus, and Bjorn Hettne
1984 Development Theory in Transition. London: Zed Books.
- Borgstorm, George
1973 Focal Points: A Global Food Strategy. New York: Macmillan.
- Bornschier, Volker, and Christopher Chase-Dunn
1985 Transnational Corporations and Underdevelopment. New York: Praeger.
- Brown, Lester
1974 By Bread Alone. New York: Praeger.
- Cereseto, Shirley
1977 "On the causes and solutions to the problem of world hunger and starvation: evidence from China, India and other places." *The Insurgent Sociologist* 7:33-52.

- Chambers, Robert
1983 Rural Development. New York: Longman.
- Chase-Dunn, Christopher
1975 "The effects of international economic dependence on development and inequality: a cross-national study." *American Sociological Review* 40:720-38.
- Cheng, Wei-Young
1989 "Testing the food-first hypothesis: a cross-national study of dependency, sectoral growth and food intake in less developed countries." *World Development* 17:17-27.
- Chirot, Daniel
1977 *Social Change in the Twentieth Century*. New York: Harcourt Brace Jovanovich.
- Coleman, James, and Donald Cressey
1993 *Social Problems*. New York: Harper Collins
- Countries of the World and their Leaders
1993 Detroit, Mich: Gale Research Co.
- Dadzie, K. K. S.
1988 "Forward." Pp. xi-xii in *Proceedings of a Seminar Organized by Islamic Development Bank and United Nations Conference on Trade and Development, Jeddah, Saudi Arabia, 1986*. New York: United Nations.
- De Janvry, Alain
1976-1977 "Material determinants of the world food crisis." *Berkeley Journal of Sociology* 21:3-26.
- Delacroix, Jacques, and Charles Ragin
1986 "Structural blockage: a cross-national study of economic dependency, state efficacy, and underdevelopment." *American Journal of Sociology* 86:1311-47.
- De Waal, Alexander
1989 *Famine that Kills: Darfur, Sudan, 1984-1985*. Oxford: Clarendon Press.

- Dos Santos, Theotonio
 1984 "The structure of dependencies." Pp. 95-104 in M. Seligson (ed.), *The Gap Between Rich and Poor*. Boulder, CO: Westview.
- Evans, Peter, and Michael Timberlake
 1980 "Dependence, inequality, and the growth of the tertiary: a comparative analysis of less developed countries." *American Sociological Review* 45:531-52.
- Fields, Gary
 1984 "Assessing progress toward greater equality of income distribution." Pp. 292-320 in M. Seligson (ed.), *The Gap Between Poor and Rich*. Boulder, CO: Westview.
- Food and Agriculture Organization
 1989 "Effects of Stabilization and Structural Adjustment Programs on Food security." Food and Agriculture Organization Economic and Social Development Paper, No. 89. Rome: United Nations.
- Gacitua, Estanislao, and Rosario Bello
 1991 "Agricultural exports, food production, and food security in Latin America." *Rural Sociology* 56:391-405.
- Geographic Distribution of Financial Flow to Developing Countries, 1982/1985. Paris:
 1987 Organization for Economic Co-operation and Development.
- George, Susan
 1977 *How the Other Half Dies: The Real Reasons for World Hunger*. Montclair, NJ: Allanheld, Osmun.
 1984 *Ill Fares the Land: Essay on Food, Hunger, and Power*. Washington, DC: Institute for Policy Studies.
 1988 *A Fate Worse Than Debt*. London: Penguin.
- Grigg, David
 1985 *The World Food Problem: 1950-1980*. New York: Basil Blackwell.
- Gunder Frank, Andre
 1969 *Latin America: Underdevelopment or Revolution*. New York: Monthly Review Press.
 1981 *Crisis In The Third World*. New York: Holms and Meir.
- Hagen, Everett
 1980 *The Economics of Development*. Homewood, IL: Richard Irwin.

- Hannah, John
1977 "The challenge of providing food for hungry people." Pp. 103-11 in *World Food Conference of 1976*. Ames, IA: Iowa State University.
- Harrison, Paul
1984 *Inside the Third World*. New York: Penguin.
- Hedderson, John
1987 *SPSSx: Made Simple*. Belmont, CA: Wadsworth.
- Heffernan, Michael, and Keith Sutton
1991 "The landscape of colonialism: the impact of French colonial rule on Algerian rural settlement pattern 1870-1087." Pp. 121-52 in C. Dixon and M. Heffernan (eds.), *Colonialism and Development in the Contemporary World*. New York: Mansell.
- Jaffee, David
1990 *Levels of Socio-economic Development Theory*. New York: Praeger.
- Jennings, Anthony, and Penny Street
1989 "Introduction." *Food Policy* 14:194-95.
- Josling, Tim
1977 "The world food problem: national and international aspect." Pp. 6-9 in R. Talbot (ed.), *The World Food Problem and U.S. Food Politics and Policies: 1972-1976*. Ames, IA: Iowa State University.
- Kotter, Herbert
1977 "Constraints to food availability imposed by the human work force." Pp. 375-85 in *World Food Conference of 1976*. Ames, IA: Iowa State University.
- Kumar, Shubh, and Michael Lipton
1988 "Introduction." *World Development* 16:993-95.
- Kurian, George
1987 *The Encyclopedia of the Third World*. New York: Facts on File.
- Lappe, Frances, and Joseph Collins
1977 *Food First: Beyond the Myth of Scarcity*. Boston, MA: Houghton Mifflin.
1979 *World Hunger: Ten Myths*. San Francisco, CA: Institute for Food and Development Policy.

- Lerner, Daniel
1967 The Passing of Traditional Society. Glencoe, IL: The Free Press.
- Lipton, Michael
1984 "Urban bias and inequality." Pp. 89-94 in M. Seligson (ed.), The Gap Between Rich and Poor. Boulder, CO: Westview.
- London, Bruce, and Thomas Robinson
1989 "The effect of international dependence on income inequality and political violence." *American Sociological Review* 54:305-08.
- London, Bruce, and Bruce Williams
1988 "Multinational corporate penetration, protest, and basic needs provision in non-core nations: a cross-national analysis." *Social Forces* 66:747-73.
- MacDonald, Scott, Margie Lindsay, David Crum (eds.)
1990 The Global Debt Crisis: Forecast for the Future. New York: Printer Publishers.
- Manley, Michael
1991 The Poverty of Nations: Reflections on Underdevelopment and the World Economy. Concord, MA: Pluto Press.
- Markov, Pael
1977 "The world food problem." Pp. 17-24 in R. Talbot (ed.), The World Food Problem and U. S. Food Politics 1972-1976. Ames, IA: Iowa State University.
- Meissner, Frank
1989 "Effecting food marketing: a tool for socio-economic development in the Third World." *Food Policy* 2:90-96.
- Mellor, John
1988 "Global food balances and food security." *World Development* 16:997-1011.
- Mensah, Moise
1977 "Relationships of food supplies and nutrition to development." Pp. 201-10 in World Food Conference of 1976. Ames, IA: Iowa State University.

- Norman, Colin
1985 "The technological challenge in Africa." *Science* 227:616-17.
- Norse, David
1979 "Natural resources, development strategies and the world food problem." Pp. 12-51 in M. Biswas and A. Biswas (eds.), *Food, Climate, and Man*. New York: Wiley.
- Norusis, Marija
1986 SPSS/PC+. For the IBM PC/XT/AT. Chicago, IL: SPSS.
1988 The SPSS Guide to Data Analysis for SPSS. Chicago, IL: SPSS.
- Olembo, R. J.
1977 "Environmental issues in current food production, marketing and processing practices." Pp. 145-62 in *World Food Conference of 1976*. Ames, IA: Iowa State University.
- Paddock, William, and Paul Paddock
1976 *Time of Famines: America and the World Food Crisis*. Boston, MA: Little Brown.
- Parfitt, Trevor, and Stephen Riley
1989 *The African Debt Crisis*. New York: Routledge.
- Paulino, Leonardo
1986 *Food in the Third World: Past Trends and Projections to 2000*. Research report No. 52. Washington, DC: International Food Policy Research Institute.
- Pesqueira, Eduardo
1990 *Ending Hunger: The Cyprus Initiative. A Summary of the Report Presented by the President of the World Food Council in the Fifteenth Ministerial Session, Cairo, Egypt, May 1989*. Hunger project. New York: United Nations.
- Presidential Commission on World Hunger
1980 *Overcoming World Hunger: The Challenge Ahead*. Washington, DC: U. S. Government Printing Office.
- Rau, Bill
1991 *From Feast to Famine: Official Cures and Grassroots Remedies to Africa's Food Crises*. London: Zed Books.

- Rostow, Walt
1960 The Stage of Economic Growth. Cambridge: University Press.
- Sachs, Moshe (ed.)
1988 Worldmark Encyclopedia of the Nations. New York: Worldmark Press.
- Schumacher, E. F.
1973 Small is Beautiful: A Study of Economics as if People Mattered.
London: Blond and Briggs.
- Seligson, Mitchell
1984 "The dual gaps: an overview of theory and research." Pp. 3-13 in M.
Seligson (ed.), The Gap Between Poor and Rich. Boulder, CO:
Westview.
- Sen, Amartya
1990 "Public action to remedy hunger." African Farm 5:41-43.
- Singer, H.W.
1992 "Beyond the debt crisis." Development 1:35-38.
- So, Alvin
1990 Social Change and Development. Newbury, CA: Sage.
- Sproull, Natalie
1988 Handbook of Research Methods. Metuchen, NJ: Screw Press.
- Strack, Dieter, and Schonherr Siegfried (eds.)
1990 Debt survey of Developing Countries, 1988. Boulder, CO: Westview
Press.
- Stokes, Randall, and Andy Anderson
1990 "Disarticulation and human welfare in less developed countries."
American Sociological Review 55:63-74.
- Tangley, Laura
1987 "Beyond the green revolution." BioScience 37:176-80.
- Taylor, Peter
1991 "The legacy of imperialism." Pp. 6-20 in C. Dixon and M. Heffernan
(eds.), Colonial and Development in the Contemporary World. New
York: Mansell.

- Tipps, Den
1973 "Modernization theory and the comparative study of societies: a critical perspective." *International Development* 8:95-101.
- Titilola, Oguntunji
1990 "The economics of incorporating indigenous knowledge systems into agricultural development: a model and analytical framework." *Studies in Technology and Social Change*, No. 17. Ames, IA: Iowa State University.
- Tolba, Mostafa
1979 "Forward." Pp. xi-xvii in M. Biswas and A. Biswas (eds.), *Food, Climate, And Man*. New York: Wiley.
- Todaro, Michael
1977 *Economic Development in the Third World* (1st ed.). New York: Longman.
1989 *Economic Development in the Third World* (4th ed.). New York: Longman.
- Toton, Suzanne
1988 *World Hunger*. New York: Orbis Books.
- United Nations
1987 *United Nations Statistical Yearbook, 1985/1986* New York: United Nations Statistical Office.
1989 *United Nations Center for Human Rights Right to Adequate Food as a Human Right*. Geneva, Switzerland: United Nations Center for Human Rights.
- United States Department of Agriculture
1989 *World Agricultural Trends and Indicators, 1970-1988*. Washington, DC: U. S. Department of Agriculture.
- Ulluwishewa, Rohana
1993 "Indigenous knowledge, national IK resource centres and sustainable development". *Indigenous Knowledge and Development Monitor* 1: 11-13.

- Valenzuela, Samuel, and Arturo Valenzuela
1981 "Modernization and dependency: alternative perspectives in the study of Latin American underdevelopment." Pp. 15-41 in H. Munoz (ed.), *Dependency to Development: Strategies to Overcome Underdevelopment and Inequality*. Boulder, CO: Westview.
- Vicker, Ray
1975 *This Hungry World*. New York: Charles Scribner's and Sons.
- Waller, James
1990 *Fau: Portrait of an Ethiopian Famine*. Jefferson, NC: McFarland.
- Warren, Michael, and Kristin Cashman
1988 "Indigenous knowledge for sustainable agriculture and rural development." A briefing paper on key sustainability issues in agricultural development. Gatekeeper series No. SA10. Washington, DC: International Institute for Environment and Development.
- Webster, Andrew
1984 *Introduction to Sociology of Development*. London: Macmillan Education.
- Weiner, Myron (ed.)
1966 "Introduction." Pp. 1-14 in *Modernization: The Dynamics of Growth*. New York: Basic Books.
- Wells, Richard, Robert Miller Jr., and Kemp Deville.
1983 "Hunger as a global social phenomenon: A case of sociological neglect." *Humanity and Society* 7:338-72.
- Wharton, Clifton, Jr.
1966 "Modernizing subsistence agriculture." Pp. 258-69 in M. Weiner (ed.), *Modernization: The Dynamics of Growth*. New York: Basic Books.
1977 "The role of the professional in feeding mankind: the political dimension." Pp. 3-13 in *World Food Conference of 1976*. Ames, IA: Iowa State University.
- Wiarda, Howard
1983 "Toward a nonethnocentric theory of development: alternative conceptions from the Third World." *Journal of Developing Areas* 17: 433-52.

Wimberley, Dale

- 1990 "Investment dependence and alternative explanations of Third World morality: a cross-national study." *American Sociological Review* 55:75-91.
- 1991 "Transnational corporate investment and food consumption in the Third World: a cross-national analysis." *Rural Sociology* 56:406-31.

Witter, Sylvan

- 1977 "Alternatives available for improving land and animal resources." Pp. 429-48 in *World Food Conference of 1976*. Ames, IA: Iowa State University.

World Bank

- 1981 *World Development Report, 1980*. New York: Oxford University Press.
- 1984 *Debt and the Developing World*. Washington, DC: World Bank.
- 1988 *World Development Report, 1987*. New York: Oxford University Press.
- 1991 *World Development Report, 1990*. New York: Oxford University Press.

World Food Conference of 1976

- 1977 *Proceedings: The World Food Conference of 1976*. Ames, IA: Iowa State University.

Yates, Geoffrey

- 1986 *Food: Need, Greed and Myopia. Exploitation and Starvation in a World of Plenty*. London: Earthright.

ACKNOWLEDGEMENTS

It was a great opportunity for me to work closely with Dr. Willis Goudy as a teaching assistant and a major professor. From his gift of teaching and research, I learned more than I can measure. I would like to take this opportunity and thank him for the time that he put on reading and criticizing the drafts of this dissertation.

My thanks also extend to the members of my committee—Eric Abbott, Eric Hoiberg, Albert King, and Michael Warren—for their time and comments. Special thanks go to Motoko Lee for her help during the early stages of my study in Iowa State University.

My utmost love and gratitude, after Allah, go to my wife and my three sons for their tremendous help, patience, and understanding. I know it has been very difficult on all of you.