

2001

# Political institutions and chronic food insecurity in developing countries: an empirical analysis

Amani El Tayeb El Obeid  
*Iowa State University*

Follow this and additional works at: <https://lib.dr.iastate.edu/rtd>

 Part of the [Economics Commons](#)

## Recommended Citation

El Obeid, Amani El Tayeb, "Political institutions and chronic food insecurity in developing countries: an empirical analysis " (2001).  
*Retrospective Theses and Dissertations*. 424.  
<https://lib.dr.iastate.edu/rtd/424>

This Dissertation is brought to you for free and open access by the Iowa State University Capstones, Theses and Dissertations at Iowa State University Digital Repository. It has been accepted for inclusion in Retrospective Theses and Dissertations by an authorized administrator of Iowa State University Digital Repository. For more information, please contact [digirep@iastate.edu](mailto:digirep@iastate.edu).

## **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.

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.

Bell & Howell Information and Learning  
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA  
800-521-0600

**UMI<sup>®</sup>**



**Political institutions and chronic food insecurity in developing countries:**

**An empirical analysis**

by

**Amani El Tayeb El Obeid**

**A dissertation submitted to the graduate faculty**

**in partial fulfillment of the requirements for the degree of**

**DOCTOR OF PHILOSOPHY**

**Major: Economics**

**Major Professors: Stanley R. Johnson and Dermot J. Hayes**

**Iowa State University**

**Ames, Iowa**

**2001**

UMI Number: 3003238

UMI<sup>®</sup>

---

UMI Microform 3003238

Copyright 2001 by Bell & Howell Information and Learning Company.

All rights reserved. This microform edition is protected against  
unauthorized copying under Title 17, United States Code.

---

Bell & Howell Information and Learning Company  
300 North Zeeb Road  
P.O. Box 1346  
Ann Arbor, MI 48106-1346

Graduate College  
Iowa State University

This is to certify that the Doctoral dissertation of  
Amani El Tayeb El Obeid  
has met the dissertation requirements of Iowa State University

Signature was redacted for privacy.

~~Co-major Professor~~

Signature was redacted for privacy.

~~Co-major Professor~~

Signature was redacted for privacy.

~~For the Major Program~~

Signature was redacted for privacy.

For the Graduate College

## TABLE OF CONTENTS

ACKNOWLEDGEMENTS	v
ABSTRACT	vi
CHAPTER 1. INTRODUCTION	1
Objective and Organization of the study	4
CHAPTER 2. FOOD SECURITY: CONCEPT AND TRENDS	6
Concepts and Definitions of Food Security	6
Food security: A brief history	6
Definition of food security	7
Food Insecurity Trends in Developing Countries	11
Past trends in food insecurity	11
Poverty	17
Future projections in food security	20
CHAPTER 3. UNDERLYING CAUSES OF CHRONIC FOOD INSECURITY	23
Poverty	23
Population and Urbanization	24
Population growth	24
Urbanization	26
Agriculture	28
Agricultural development	28
Science policy for agriculture	31
Historical trends	33
Access to land	35
Terms of trade	36
Overvalued Exchange Rate	36
Access to Credit	37
Education	38
Export Earnings	38
Food Aid	39
External Debt	41
Political Participation	41
CHAPTER 4. THE ISSUE OF POLITICAL INSTITUTIONS	43
Political Institutions and Economic Growth	43
Theoretical perspective	43
Studies on political institutions and economic growth	45
Political Institutions and Food Insecurity	47
CHAPTER 5. DESCRIPTION OF THE VARIABLES	53
Discussion of Some of the Model Variables	53

Dependent variable	53
Political variables	55
Economic variables	56
Description of the Data	58
Choice of Data Sources	61
<b>CHAPTER 6. EMPIRICAL RESULTS AND DISCUSSION</b>	<b>62</b>
Economic Growth and Political Institutions	63
Previous empirical studies on economic growth	63
Empirical Results	65
Income and political institutions	65
Per capita dietary energy supply and income	72
Ordinary Least Squares regression results	74
Two-stage Least Squares regression results	81
<b>CHAPTER 7. SUMMARY AND CONCLUSION</b>	<b>84</b>
Implications of the study	86
<b>APPENDIX A. CHECKLIST FOR POLITICAL RIGHTS AND CIVIL LIBERTIES</b>	<b>88</b>
<b>APPENDIX B. ECONOMIC FACTORS IN THE HERITAGE HOUSE INDEX OF ECONOMIC FREEDOM</b>	<b>90</b>
<b>APPENDIX C. INDICATORS IN THE FREEDOM HOUSE INDEX OF ECONOMIC FREEDOM</b>	<b>92</b>
<b>APPENDIX D. DESCRIPTION OF REGRESSION VARIABLES AND DATA INFORMATION</b>	<b>94</b>
<b>APPENDIX E. 2SLS REGRESSION ESTIMATES WITH POLITICAL VARIABLES AS THE INDEPENDENT VARIABLES</b>	<b>98</b>
<b>REFERENCES</b>	<b>100</b>



## ACKNOWLEDGEMENTS

My co-major professor, Dr. Stanley R. Johnson, deserves more than my thanks and my gratitude for his continued support during my graduate studies. He introduced me to the issues of food insecurity and opened many avenues for me both academically and personally. I am also eternally indebted to my co-major professor, Dr. Dermot J. Hayes, for all the help and assistance he so generously and selflessly provided me. Without him, I am not sure that I would have been able to complete this degree. I would like to thank Dr. Helen Jensen, Dr. Wallace Huffman and Dr. Alicia Carriquiry for serving as members on my dissertation committee and for their invaluable advice and suggestions. I would also like to thank the Department of Economics and the Center for Agricultural and Rural Development for the financial support I received during my studies and for the opportunity to complete a Ph.D. degree. My husband, Thomas Gleisner, was my pillar of strength and support and stood by my side every step of the way. For that, I am forever grateful. My thanks are also extended to my parents-in-law, Mary Kay and William Gleisner, for their love and support and to my dear friend, Susan Benner who always went beyond the call of duty to help me in any way she could. Finally, my deepest love and gratitude go to my mother, who has endured years of separation, for supporting me in my endeavor to fulfil my academic goals.

**ABSTRACT**

World food production is growing at a faster rate than population growth and per capita food energy has increased in developing countries. However, approximately 800 million people in the developing world still do not have access to sufficient food for an adequate diet. An additional quarter of a billion people periodically face food inaccessibility due to weather, instability in prices and employment, drought, diseases and civil strife. Furthermore, the distribution of food is uneven around the world.

There have been a number of theses advanced on why millions of people around the world go hungry including poverty, rapid population and urban growth, uneven distribution of food, inadequate domestic agricultural production, trade barriers and inappropriate macroeconomic policies leading to negative or slow economic growth. However, an important factor that has not been investigated is the relationship between food insecurity and the political institutions in developing countries.

The objective of this study is to better understand the sources of food security problems in developing countries and to explore empirically the strength of selected factors in explaining the underlying reasons for food security problems. The study provides an empirical analysis of the causes of chronic food insecurity including the much ignored political, civil and economic freedoms. A cross-sectional econometric model is used with data from 153 developed and developing countries for the period 1995.

The empirical analysis assesses the relative importance of the factors hypothesized to explain the differences among countries for a widely used indicator of food insecurity. The indicator of food insecurity, per capita dietary energy supply, is regressed on selected

economic variables including measures of political rights and civil liberties, and economic freedom. The results show that political rights and civil liberties impact food security in developing countries indirectly through income. Countries that enjoy political and civil freedoms tend to enjoy higher incomes and in turn, are more food-secure than countries where these freedoms are repressed. These results suggest that the institutions of developing countries, which underlie these rights or freedoms, are critical in the design of interventions to alleviate poverty and therefore, food insecurity.

## CHAPTER 1. INTRODUCTION

The world food situation appears promising at a first glance. World food production is growing at a faster rate than population growth. Food production increased by 2.4 percent per annum between 1960 and 1980, although this rate has declined in recent years due to a reduction in food production in the developed world. During the 1980s, global grain production increased annually by 2.1 percent while population grew by 1.7 percent. Per capita food production is approximately 18 percent higher than it was thirty years ago (Mitchell and Ingco 1995). Cereal yields have more than doubled during the period from 1960 to 1990 and real food prices have been declining. Between 1981 and 1985, real world prices for cereals fell by 30 percent. Net cereal exports from developing countries increased by 80 percent between the mid-1970s and the mid-1980s (Mellor 1992).

In terms of availability of per capita food energy, the increases have amounted to 0.7 percent per year for developing countries during the 1980s with China and the Far East experiencing the greatest increases and Latin America and Africa experiencing the smallest increases (Pinstrup-Andersen 1994). The number of developing countries where per capita food availability was lower than the sufficient amount of food energy specified by the Food and Agriculture Organization of the United Nations (FAO) (about 2200 calories per person per day) decreased from 45 countries at the end of the 1970s to 25 countries by the end of the 1980s (Pinstrup-Andersen 1994).

However, approximately 800 million people in the developing world still do not have access to sufficient food for an adequate diet. An additional quarter of a billion people periodically face food inaccessibility due to weather, instability in prices and employment,

drought, diseases and civil strife (Tweeten et al. 1992). Furthermore, the distribution of food is uneven around the world. According to the United States Department of Agriculture (USDA 1996), average per capita food consumption is more than 50 percent higher in developed countries than in sub-Saharan Africa.

It is predicted that the world will continue to produce enough food to meet demand and that real food prices will continue to decline during the next 25 years. Yet millions of people around the world will continue to be malnourished<sup>1</sup>. Food production in many developing countries is unlikely to keep pace with the demands of their growing populations. In the developing world, the demand for food in 2025 is expected to be more than double current production levels (McCalla 1994).

A number of reasons have been advanced to explain why millions of people around the world go hungry. Scarcity of food is not the sole source of hunger and malnutrition. Evidence suggests that even when domestic food availability is high, people in developing countries remain at risk because of their inability to acquire food. Rapid population and urban growth, uneven distribution of food, inadequate domestic agricultural production, trade barriers and inappropriate macroeconomic policies, and natural disasters, war and civil strife are cited among the main factors (IDRC 1992). However, poverty is considered to be the major cause of food unavailability and food inaccessibility for most of the world's poor.

According to von Braun (1992), the food problems of the poor are the result of low and unstable incomes and a lack of adequate health and sanitation services. Scarcity of land, low

---

<sup>1</sup> Malnutrition is defined as a nutritional disorder resulting from inadequate nutrition. There are four types of malnutrition: overnutrition, dietary deficiency, secondary malnutrition and undernutrition. Overnutrition is the result of consumption of too many calories; dietary deficiency results from insufficient amounts of essential nutrients in the diet; secondary malnutrition occurs when a sick individual is unable to properly digest or absorb some of the food; and undernutrition is the result of insufficient calories or protein in the diet required to lead an active healthy life (Foster 1992). Malnutrition in developing countries is predominantly undernutrition.

investments in human capital, low and declining investments in agricultural research and development, absence of productivity-enhancing technology, inadequate infrastructure, poor market facilities and high transportation costs have contributed to low labor productivity in many rural areas which, in turn, has led to low levels of income. As a result of low productivity levels, food producers have become increasingly vulnerable to adverse weather conditions, pest infestations, and crop diseases. Marginal lands, environmental degradation and the prevalence of subsistence farming have also contributed to low food production, particularly in sub-Saharan Africa (Christensen et al. 1981).

Pinstrup-Andersen and Pandya-Lorch (1998) evaluated developments and emerging issues in the global food situation that may result in higher risks of food insecurity for developing countries in the future. Concerns about food insecurity have been heightened by the sharp reduction in global cereal stocks and the anticipated volatility of international prices of wheat and maize. The economic crisis facing Eastern Europe and the former Soviet Union, the reduction in food aid and official development assistance to developing countries, and adverse weather patterns affecting agricultural production are among the recent developments that are expected to impact global food security.

Changes in dietary patterns and the increase in demand for livestock products in developing countries are among the emerging issues that may exacerbate food insecurity problems. Furthermore, lower cereal production in developing countries due to slower increases in cereal yields and cultivated areas is expected to result in higher food imports by developing countries. Higher production is hindered further by the growing scarcity and inefficient use of water, and the declining soil fertility particularly in Africa. Armed conflict in developing countries, and the impact of China and India in the global food market are also

among the issues that are expected to affect future food security (Pinstrup-Andersen and Pandya-Lorch 1998).

One factor that has not been investigated is the relationship between food insecurity and the type of political and/or institutional structure of the developing countries. Studies have shown that there is a link between political institutions and economic growth although the direction of causality and the sign of the effect have been debated (Deaton 1993). There is evidence that the extent of the political power exercised by consumers and producers influences decisions on agricultural policies, agricultural research and development strategies. Furthermore, the amount of financial support given to a country is sometimes affected by its political situation.

### **Objective and Organization of the Study**

The objective of this study is to better understand food security problems in developing countries and to explore empirically the validity of selected factors in explaining the underlying reasons for these food security problems. In particular, the role of political rights, civil liberties and economic freedoms in food insecurity will be examined. The aim is to show whether political and related institutions must be taken into consideration, particularly when economic and development policy decisions are made. The contribution of this study is to establish that programs targeting the alleviation of poverty and hunger will likely be unsuccessful if implemented in non-democratic or politically restrictive nations with limited civil liberties.

Chapter 2 reviews the concepts and definitions of food security, and presents data on the trends in food insecurity in developing countries. A number of definitions for food security have been presented by different organizations. Furthermore, food insecurity has

different dimensions that are also discussed in Chapter 2. Chapter 3 examines the empirical evidence on selected factors presented in the literature as the underlying causes of chronic food insecurity, and introduces the concepts of political rights and civil liberties as possible contributors to food insecurity in developing countries. Chapter 4 details the studies offered in the literature on the relationship between political institutions, and civil liberties, and economic growth and sets up the link between the underlying institutions and food insecurity. Chapter 5 offers a detailed discussion of some of the model variables and a description of the data. Chapter 6 presents the econometric model and the empirical results. Chapter 7 provides the summary and conclusion for the current study.



## **CHAPTER 2. FOOD SECURITY: CONCEPT AND TRENDS**

### **Concepts and Definitions of Food Security**

#### **Food security: A brief history**

The concept of food security has changed significantly over the past five decades. During the early 1940s the concept of food security included “freedom from want” and a focus on providing sufficient and secure food supply for all. The 1950s brought about bilateral food aid and the disposal of agricultural surplus commodities by developed countries in developing countries for purposes of economic development. During the 1960s, the concept of food security changed to that of increased food self-sufficiency through increased food production in developing countries (Phillips and Taylor 1991).

A combination of bad weather and crop failure, the energy crisis and the entrance of the USSR into world grain markets during the early 1970s led to a dramatic increase in food prices and a reduction in grain reserves to their lowest levels in 25 years. As a result, the focus of food security turned to food insurance and establishing and maintaining adequate national and global food stocks (Phillips and Taylor 1991).

During the 1980s came the realization that food crises were not necessarily caused by drastic shortfalls in food production but by sharp reductions in the purchasing power of the poor. National levels of food supplies could be sufficient and malnutrition could still be widespread within a country. Special attention to the food crisis in Africa also began during that period (Phillips and Taylor 1991). The eradication of hunger and poverty has become a priority during the 1990s especially for organizations such as the United Nations and the World Bank. These organizations are also attempting to redefine global food security

problems to include such issues as women's rights and gender roles (for example, World Food Day 1998).

### **Definition of food security**

Different organizations have attempted to define food security. However, the various definitions are, in substance, very similar (Table 2.1). The most widely used definition of food security is offered by the World Bank as "access by all people at all times to enough food for an active, healthy life" (World Bank 1986, 1). Household food security is "the ability of the household to secure enough food to ensure adequate dietary intake for all its members" (von Braun et al. 1992, 6). Although access to food is necessary, it is not a sufficient condition for food security. Factors such as health, a sanitary environment and health care are also important. The concept of food security also addresses people's risks of not having access to the required food.

The essential elements of food security are the availability of and access to food and the risks related to the two. Availability of food is determined mainly by levels and variability of food production, stocks and trade. In terms of access to food, poverty is a major determinant of chronic household food insecurity. Even with sufficient food supply in domestic markets, the poor do not have the means to purchase food. A country's ability to access food from the international market is determined by world prices, availability of foreign exchange and, in many cases, the supply of food aid. In addition to unavailability of food supplies leading to energy deficiencies, food insecurity may also take the form of micronutrient deficiencies such as vitamin A and iron (Phillips and Taylor 1991).

Table 2.1. Definitions of food security by various organizations

Organization	Definition
World Bank	Food security is access by all people at all times to enough food for an active, healthy life. Food insecurity, in turn, is the lack of access to enough food.
FAO <sup>a</sup>	Food security is ensuring that all people at all times have both physical and economic access to the basic food they need.
SCN <sup>a</sup>	A household is food secure when it has access to the food needed for a healthy life for all its members (adequate in terms of quality, safety and culturally acceptable) and when it is not at undue risk of losing such access.
UNICEF <sup>a</sup>	Food security means the assurance of foods to meet the needs of all its members throughout each season of the year. National food security means adequate food supplies through local production and food imports. Household food security focuses on the family's capacity to produce and acquire food.
IFAD <sup>a</sup>	Household food security is defined as a goal, operationalized through a set of principles or values that ought to be adhered to in all development measures to ensure access to adequate food by and for households over time.
UNSTD <sup>a</sup>	Food security refers to a country's ability to have stable and reliable access to the food it needs through a mixture of production, trade, purchase or barter. The mixture is seen to vary according to the resource endowments of the country and its comparative advantage in different types of food, fibre and industrial production. Food security can also be used at the household level and implies stability in access to food through sufficient food self-provisioning and/or food purchasing power whatever the season of the year.

<sup>a</sup> FAO: Food and Agriculture Organization of the United Nations; SCN: United Nations Administrative Committee on Coordination – Sub-Committee on Nutrition; UNICEF: United Nations Children's Fund; IFAD: International Fund for Agricultural Development; UNSTD: United Nations Advisory Committee on Science and Technology for Development.

Source: Phillips and Taylor 1991.

There are different dimensions of food insecurity: chronic, transitory, short-term and long-term and each requires a separate indicator for appropriate measurement. Chronic food insecurity is a continuously inadequate diet resulting from persistent inability to acquire required food, either in the market or through production. Chronic food insecurity may result in increased vulnerability to disease and parasites, productivity losses and misallocation of resources due to lower work performance and diminished cognitive ability. This may lead to lower output and income thus continuing the cycle of poverty (World Bank 1986; von Braun et al. 1992).

Transitory food insecurity results from a temporary decline in the household's ability to access enough food due to instability in food prices, food production or incomes. Transitory food insecurity can be measured through variables that influence food consumption, namely, world and domestic food prices and household purchasing power (World Bank 1986). Famine is the most severe form of transitory food insecurity. Food insecurity can be the result of man-made and/or natural circumstances and it rarely affects everyone equally (Binswanger and Landell-Mills 1995).

Food security is generally measured at the global, regional, national, household and individual levels. Measurements at each level address different concerns. Global, regional and national food security can be measured using food demand, supply, and stock and trade indicators. At the household level, food security is measured using direct surveys of dietary intake and by levels and changes in socioeconomic and demographic variables that indicate the status and changes in food security. Anthropometric measurements are also used to measure household food security. Individual food insecurity can be measured through the incidence of malnutrition, a consequence of deficiencies in protein and micronutrients resulting from an inadequate diet and which impair the ability to lead a healthy, active life (von Braun et al. 1992).

Measurements at the individual level are concerned with the impact of food insecurity on an individual's health and performance. Measurements of individual household members can be aggregated to reach conclusions about national food security. However, measurements at the national level cannot be used to indicate the level of household food security (Phillips and Taylor 1991).

There has been some debate on the appropriate measure or indicator of food insecurity and the level at which food security analysis should be targeted (for example, household versus national food insecurity). This debate and the results of the analysis in turn have different implications for the types of interventions required to alleviate food insecurity. Difficulties with definition and measurement of food insecurity, coupled with inadequate data, have also affected the estimates of how many individuals are food insecure (von Braun 1992).

Different policies are used to reduce chronic and transitory food insecurity. Reduction of chronic food insecurity may be achieved by increasing domestic production and/or imports or improving market integration to increase the food supply; implementing development assistance or income transfer programs targeting the poor; and improving the knowledge of the poor in terms of nutritional and health practices. To reduce transitory food insecurity, policies need to be directed at stabilizing food supplies and prices as well as helping the poor with employment, income transfers or food (Binswanger and Landell-Mills 1995).

It is important to point out that there is a clear distinction between hunger and food security. Hunger, a recurring feature of absolute poverty, can be defined as the “inability to eat sufficient food in terms of calories and nutrients to lead a healthy and active life” (Webb and von Braun 1994, p. 204). Food security is the absence of hunger and the absence of risk relating to adequate food consumption. Food insecurity is the result of a complex combination of shortages in the food supply, political and economic disruptions, massive income collapse associated with disruptions in the labor or food markets and institutional and policy failures (Webb and von Braun 1994).

Food security does not necessarily imply food self-sufficiency. Food self-sufficiency is the extent to which a nation can meet its food needs from domestic production. There is a debate among economists on the benefits of achieving self-sufficiency in food by developing countries. A number of developing nations have made food self-sufficiency a priority to limit dependence on the world market and vulnerability to food-exporting countries.

The argument against self-sufficiency is that these countries are not making full use of their productive potential if they do not have a comparative advantage in the production of food commodities. Proponents of food self-sufficiency argue that developing countries export primary agricultural commodities that face declining terms of trade and unstable international markets. This makes it difficult for these countries to import food because of fluctuating export earnings. Countries that have depended on food imports, whether through price distortions (from overvalued exchange rates for example) or food aid, are tempted to implement policies that are biased against agriculture and food production (Thomson and Metz 1997). It is imperative however that increased food supplies, whether through higher domestic production or imports, are accessible to the populations who need more food.

### **Food Insecurity Trends in Developing Countries**

#### **Past trends in food insecurity**

A review of global grain production and prices of grains in the world market during the last three decades shows a growth rate that has outpaced the growth in population and a declining trend in real prices. This is an indication of the availability of food in the world as

a whole and is reflected in the 11 percent increase in global per capita dietary energy supply<sup>2</sup>, from 2440 to 2720 kilocalories per day between 1969 and 1992 (FAO 1996).

However, there has been a global slowdown in the growth of per capita dietary energy supply and a decline in per capita dietary energy supply in absolute terms in many parts of the world. This has been the result of negative annual economic growth rates in the transition countries (Eastern Europe and the former Soviet Union) and in sub-Saharan Africa. Sub-Saharan Africa experienced a negative growth rate in per capita dietary energy supply during the 1970s and 1980s. A high growth in the dietary energy supply was offset by a high population growth rate. Per capita dietary energy supply increased in South Asia as a result of a decline in population growth and an increase in the growth rate of dietary energy supply (FAO 1996).

Table 2.2 shows the per capita food consumption for the period between the mid-1960s to the mid-1990s. Between the mid-1960s and the mid-1970s, per capita food consumption increased in all the regions in the world. However, per capita food consumption declined in sub-Saharan Africa from 2093 kilocalories per day during the mid-1970s to 2039 kilocalories per day during the mid-1990s (the lowest in the world). Sub-Saharan Africa experienced an increase in per capita food consumption during the 1995/97 period to 2188 kilocalories per day. Per capita food consumption increased in Latin America and the Caribbean from 2543 kilocalories per day in the mid-1970s to 2685 kilocalories per day during the mid-1980s, and it increased to 2791 kilocalories per day by the mid-1990s.

---

<sup>2</sup> Dietary energy supply is the total food availability estimate provided by the Food and Agriculture Organization of the United Nations. It is obtained by aggregating the energy or nutritive values of the food component of commodities available for human consumption.

Table 2.2. Per capita food consumption<sup>a</sup> (kcal/person/day) in developing countries

Region	Period	Per capita food consumption
World	1964/66	2357
	1974/76	2429
	1984/86	2643
	1995/97	2761
Developing countries	1964/66	2053
	1974/76	2145
	1984/86	2433
	1995/97	2626
Sub-Saharan Africa	1964/66	2091
	1974/76	2093
	1984/86	2039
	1995/97	2188
Near East and North Africa	1964/66	2277
	1974/76	2574
	1984/86	2926
	1995/97	2983
East Asia	1964/66	1953
	1974/76	2094
	1984/86	2544
	1995/97	2783
South Asia	1964/66	2013
	1974/76	1977
	1984/86	2184
	1995/97	2424
Latin America and the Caribbean	1964/66	2392
	1974/76	2543
	1984/86	2685
	1995/97	2791
Industrial countries	1964/66	2945
	1974/76	3065
	1984/86	3218
	1995/97	3374
Transition countries	1964/66	3222
	1974/76	3385
	1984/86	3378
	1995/97	2901

<sup>a</sup> The data is taken from the national Food Balance Sheets and not from consumption surveys. Therefore, the per capita food consumption is actually national average apparent food consumption. Source: FAO 2000.



East Asia and South Asia had the lowest per capita food consumption in the mid-1970s (2094 and 1977 kilocalories per day respectively) but this increased to 2783 and 2424 kilocalories per day respectively by 1995/97. Near East and North Africa had the highest per capita food consumption in the developing region in 1995/97 at 2983 kilocalories per day, up from 2926 kilocalories per day in the mid-1980s. However, these numbers are well below the consumption levels in developed nations where in 1995/97 the per capita food consumption averaged approximately 3400 kilocalories per day (FAO 2000).

The number of undernourished people in the developing world declined from 959 million during the period 1969/71 to 828 million during the period 1990/92 and finally to 790 million during the period 1995/97. The proportion of undernourished fell from 37 percent to 20 percent and then to 18 percent during the same periods. Table 2.3 provides a breakdown of the proportion and number of undernourished people by region. It is evident that sub-Saharan Africa had the highest proportion of undernourished population in the 1990s (33 percent in 1995/97).

The number of undernourished increased in sub-Saharan Africa from 88 million in 1969/71 to 125 million in 1979/81 to 180 million during the period 1995/97. Although East Asia had the second highest number of undernourished in 1990/92 (283 million), this number declined from 406 million during the period 1979/81 and declined further to 240 million in the 1995/97 period. The proportion of undernourished in the region also fell from 29 percent to 17 percent between 1979/81 and 1995/97, the largest improvement in the developing world.

**Table 2.3. Incidence of undernourishment in developing countries**

<b>Region</b>	<b>Period</b>	<b>Percent of population</b>	<b>Number of undernourished (million)</b>
<b>Developing countries</b>	1969-71	37	959
	1979-81	29	937
	1990-92	20	828
	1995-97	18	790
<b>Sub-Saharan Africa</b>	1969-71	34	88
	1979-81	36	125
	1990-92	34	162
	1995-97	33	180
<b>Near East and North Africa</b>	1969-71	25	45
	1979-81	9	22
	1990-92	8	25
	1995-97	9	33
<b>East Asia</b>	1969-71	43	504
	1979-81	29	406
	1990-92	17	283
	1995-97	13	240
<b>South Asia</b>	1969-71	37	267
	1979-81	38	337
	1990-92	26	299
	1995-97	23	284
<b>Latin America and the Caribbean</b>	1969-71	19	54
	1979-81	13	46
	1990-92	13	59
	1995-97	11	53

Source: FAO 2000.

The number of undernourished declined in Near East and North Africa from 45 to 33 million during the 30-year period between 1969 and 1997, although the number has more recently increased when compared to 25 million undernourished in the early 1990s. The proportion of undernourished fell from 25 percent to 9 percent during the decade from 1970 to 1980 but this percentage has not improved significantly since then. In South Asia the number and proportion of undernourished increased from 267 to 337 million and from 37 to 38 percent between 1969 and 1981 respectively. By 1992, the number of undernourished decreased to 299 million and the proportion of undernourished declined to 26 percent.

The mid-1990s saw another improvement in South Asia when the number of undernourished declined further to 284 million and the proportion declined to 23 percent. Latin America and the Caribbean experienced an overall increase in the number of undernourished from 54 to 59 million between 1969 and 1992. The proportion of undernourished in the region fell from 19 percent to 13 percent. Although, the number of undernourished increased from 46 million to 59 million between 1979 and 1992, the proportion remained unchanged at 13 percent. Both the number and proportion of undernourished declined in the mid-1990s in Latin America and the Caribbean to 53 million and 11 percent respectively when compared to the early 1990s (FAO 2000).

Sub-Saharan Africa represented 9 percent of the total number of people with inadequate food access in the developing world in the early 1970s. This proportion increased to 23 percent by the mid-1990s. The share of undernourished also increased in Latin America and the Caribbean from 6 percent to 7 percent and in South Asia from 28 percent to 36 percent during the same period. The share of undernourished people in the developing region declined in East Asia and in Near East and North Africa from 53 percent and 5 percent during the period 1969-71 to 30 percent and 4 percent during the period 1995/97 respectively (FAO 2000).

According to the FAO (1996), per capita dietary energy supplies in some developing countries have reached required levels and thus food inadequacy, or the energy deficiency relative to requirement standards, could be eliminated through redistribution efforts. However, increases in per capita food supplies are still necessary for the majority of developing countries. In the developing world, the undernourished population was consuming well below the average per capita energy requirement of approximately 2170

kilocalories per day in the early 1990s. The undernourished in sub-Saharan Africa were consuming 1470 kilocalories per day, the lowest in the developing region. The undernourished were consuming 1580 kilocalories per day in South Asia, 1660 kilocalories per day in East and Southeast Asia and in Latin America and the Caribbean, and 1640 kilocalories per day in Near East and North Africa during the same period (FAO 1996).

### **Poverty**

In addition to assessing the per capita dietary energy supply, the level and prevalence of poverty in many developing countries can be used as another indicator of food insecurity since poverty is the basic cause of inaccessibility to food in the developing world. More than one-half of the 1.1 billion people living in poverty in developing countries in 1990 lived in conditions of extreme poverty. Fifty percent of the poor in the developing world lived in South Asia, 15 percent in East Asia, 19 percent in sub-Saharan Africa, and 10 percent in Latin America and the Caribbean in 1990. In both South Asia and Africa, 50 percent of the population is poor (Pinstrup-Andersen 1994).

It is projected that there will be significant reductions in poverty in both East and South Asia. In sub-Saharan Africa however, the number of poor was estimated to rise to 304 million by 2000, an increase of almost 50 percent. By the same year, the percentage of the developing world's poor who reside in sub-Saharan Africa was predicted to rise from 19 percent to approximately 33 percent (Pinstrup-Andersen 1994).

Table 2.4 shows the population living in absolute poverty in developing and transitional economies for selected years. Von Braun (1992) defines absolute poverty as the inability of individuals to meet basic food and non-food consumption needs to live an active healthy life. The absolute poverty rate here is determined by the proportion of people whose income is

less than one dollar a day. The measure is based on 1993 purchasing power parities and household survey data.

The figures show that both the share of population and the number of people living in poverty increased between 1987 and 1993 before declining significantly by 1998. South Asia has the largest number of people living on less than \$1 a day, followed by East Asia and the Pacific and sub-Saharan Africa. When China is excluded from East Asia and the Pacific, sub-Saharan Africa becomes the region with the second largest number of people living in absolute poverty. The number of people living in poverty increased in South Asia, sub-Saharan Africa, Latin America and the Caribbean, and the transition economies from 1987 to 1993 and then again from 1993 to 1998. The population living on less than \$1 a day declined and then rose in the Middle East and North Africa during the same period.

Table 2.4. People living on less than \$1 per day and headcount index in developing and transitional economies, selected years, 1987-1998

Region	Population covered by at least one survey (percent)	Number of people living on less than \$1 a day (millions)			Headcount index (percent)		
		1987	1993	1998 (est.)	1987	1993	1998 (est.)
East Asia and the Pacific (excluding China)	90.8	417.5	431.9	278.3	26.6	25.2	15.3
Eastern Europe and Central Asia	71.1	114.1	83.5	65.1	23.9	15.9	11.3
Latin America and the Caribbean	81.7	1.1	18.3	24.0	0.2	4.0	5.1
Middle East and North Africa	88.0	63.7	70.8	78.2	15.3	15.3	15.6
South Asia	52.5	9.3	5.0	5.5	4.3	1.9	1.9
Sub-Saharan Africa	97.9	474.4	505.1	522.0	44.9	42.4	40.0
Total	72.9	217.2	273.3	290.9	46.6	49.7	46.3
Total (excluding China)	88.1	1,183.2	1,304.3	1,198.9	28.3	28.1	24.0
	84.2	879.8	955.9	985.7	28.5	27.7	26.2

Source: The World Bank 1999.

In terms of the headcount index<sup>3</sup>, sub-Saharan Africa had the highest percentage of population living below the poverty line. However, this percentage declined from 49.7 percent in 1993 to 46.3 percent in 1998. South Asia had the second highest percentage of people living below the poverty line although the figures declined slightly between 1987 and 1993 and between 1993 and 1998. The headcount index declined for East Asia and the Pacific during the same period. However, the index increased between 1993 and 1998 for Eastern Europe and Central Asia and for Latin America and the Caribbean and remained unchanged for the Middle East and North Africa. The developing countries and transition economies as a whole experienced a decline in the percentage of the population living below the poverty line between 1987 and 1998.

Table 2.5 presents the number of people and the headcount index of people living on less than \$2 a day in developing and transitional economies. In absolute terms, East Asia and the Pacific experienced the most number of people living on less than \$2 a day in 1987, 1993 and 1998. South Asia becomes the region with the largest number of people living on less than \$2 per day when China is excluded from the East Asia and the Pacific region. This is followed by sub-Saharan Africa with 474 million people living on less than \$2 a day in 1998. The number of people living on less than \$2 increased for sub-Saharan Africa, South Asia, Latin America and the Caribbean, and Eastern Europe and Central Asia between 1987 and 1993 and between 1993 and 1998. The numbers declined for East Asia and the Pacific but declined and then increased for the Middle East and North Africa during the same period.

---

<sup>3</sup> The headcount index is the percentage of the population below the poverty line.

Table 2.5. People living on less than \$2 per day and headcount index in developing and transitional economies, selected years, 1987-1998

Region	Population covered by at least one survey (percent)	Number of people living on less than \$2 a day (millions)			Headcount index (percent)		
		1987	1993	1998 (est.)	1987	1993	1998 (est.)
East Asia and the Pacific (excluding China)	90.8	1,052.3	1,035.8	892.2	67.0	60.5	47.1
Eastern Europe and Central Asia	71.1	299.9	271.6	260.1	62.9	51.6	45.0
Latin America and the Caribbean	81.7	16.3	79.4	92.9	3.6	17.2	19.9
Middle East and North Africa	88.0	147.6	162.2	182.9	35.5	35.1	36.4
South Asia	52.5	65.1	61.7	62.4	30.0	24.1	21.9
Sub-Saharan Africa	97.9	911.0	1,017.8	1,095.9	86.3	85.4	84.0
Total	72.9	356.6	427.8	474.8	76.5	77.8	75.6
(excluding China)	88.1	2,549.0	2,784.8	2,801.0	61.0	60.1	56.0
	84.2	1,796.6	2,020.5	2,168.9	58.2	58.6	57.6

Source: The World Bank 1999.

South Asia remains the highest also in terms of the percentage of people below the poverty line, although the percentage declined between 1987 and 1998. The headcount index declined for East Asia and the Pacific and for the Middle East and North Africa during the same period. The index increased for the transition economies and declined but then rose for Latin America and the Caribbean between 1987 and 1998. Sub-Saharan Africa experienced an increase in the headcount index between 1987 and 1993 followed by a decline between 1993 and 1997. The regions as a whole experienced a decline during the same period.

#### **Future projections in food security**

The number of chronically undernourished people is projected to decline from the current 790 million (in 1995/97) to 576 million by 2015 and to 401 million by 2030 (Table 2.6). The numbers are expected to fall in East and South Asia, and Latin America but rise in sub-Saharan Africa, and West Asia and North Africa by 2015. About 70 percent of the world's chronically undernourished people will live in sub-Saharan Africa and South Asia (Pinstrup-Andersen, Pandya-Lorch and Rosegrant 1997). Sub-Saharan Africa's share of the

world's chronically undernourished population will increase from 23 percent in 1995/97 to 32 percent by 2015 and to 41 percent by 2030 (Table 2.6).

Global per capita food availability is projected to increase from 2,761 kilocalories per day in 1995/97 to 2,960 kilocalories per day in 2015 and 3100 kilocalories per day in 2030. The largest increases are expected in China and East Asia and the smallest increases in West Asia and North Africa. In sub-Saharan Africa, average per capita food availability is projected to be about 2,400 kilocalories per day, slightly above the required minimum for an active, healthy life (Pinstrup-Andersen, Pandya-Lorch and Rosegrant 1997).

**Table 2.6. Projections of proportion and number of undernourished population and of per capita food consumption in developing countries, 2015 and 2030**

Region	Year	Proportion of undernourished (percent of populations)	Number of undernourished (millions)	Per capita food consumption (kcal/person/day)
Developing countries	2015	10	576	2860
	2030	6	401	3020
Sub-Saharan Africa	2015	22	184	2400
	2030	15	165	2580
Near East and North Africa	2015	8	38	3090
	2030	6	35	3170
Latin America and the Caribbean	2015	7	45	2950
	2030	5	32	3080
South Asia	2015	10	165	2790
	2030	4	82	3040
East Asia	2015	7	144	3020
	2030	4	86	3170

Source: FAO 2000.



In terms of the global trends in food demand and supply, average yield gains may no longer exceed gains in average food demand as experienced during the 1950s and 1960s. Tweeten (1998) anticipates a much smaller gap between the growth in global food supply and food demand which could imply further suffering for the chronically undernourished populations in the developing world. The growth in cereal yields is declining and overall food production is projected to grow 1.28 percent in year 2000 and decline to 0.77 percent by 2050. If population growth remains at 1.5 percent (1996 level), this could provide a real challenge to global food security in the future. Some studies project zero population growth by the end of the twenty-first century (Table 2.7). Depending on the study, food demand is estimated to increase between 144 and 201 percent over the 1995 level (Tweeten 1998).

**Table 2.7. Total and annual food demand growth to zero population growth from 1995**

Study	Population at zero population growth <sup>a</sup> (billion)	Year of zero population growth <sup>a</sup>	Food demand growth from 1995 <sup>b</sup> (percent)
International Institute of Applied Systems Analysis	10.5	2084	144
United Nations <sup>c</sup>	10.3	2094	147
World Bank	11.3	2128	201

<sup>a</sup> When data from the source were incomplete, the population at zero population growth and year are projected using a quadratic equation fitted to available data.

<sup>b</sup> Assumes per capita demand grows 0.3 percent per year from income.

<sup>c</sup> Medium population projections.

Note: 1995 world population 5.6 billion.

Source: Tweeten 1998.

### **CHAPTER 3. UNDERLYING CAUSES OF CHRONIC FOOD INSECURITY**

This chapter provides a discussion of various factors presented in the literature as the underlying causes of chronic food insecurity. This discussion is then used to identify, as well as offer a justification for, the variables used in the empirical model presented in Chapter 5. There is a general consensus that certain factors, such as poverty, have contributed to food insecurity in the developing world (World Bank 1986; Pinstrup-Andersen 1994; Alexandratos 1995). However, there is debate on whether other factors, population growth and food aid for example, have a negative effect on food security. Counter-arguments are offered in these cases.

#### **Poverty**

Food insecurity is considered in terms of food availability and food access. Food may be available at a global, national or household level, but individuals may not have access to food because they cannot purchase it (Webb and von Braun 1994). Therefore, poverty is considered by many studies to be the root cause of hunger. The literature on poverty indicates that poverty may be the result of limited resources, lack of access to resources, low level of development, lack of access to assets such as land, capital, skills or income and inappropriate economic policies.

Poverty is partly a function of country income per capita. Some studies have indicated a close relationship between average per capita income and average per capita consumption of calories and a positive association between the growth of average income and the growth of average per capita consumption irrespective of the level of average income. Income distribution has also been shown to play a significant role: countries with less equal income

distributions have more poor, therefore hungry, people (Birdsall 1994). Low and unstable household incomes, limited asset wealth, low human capital and labor productivity, and high risk of income and consumption instability are considered characteristics of at-risk food-insecure populations (Webb and von Braun 1994).

However, the relationship between poverty and food security is complex. Poor people who can produce their own food may be more food secure than people with higher levels of income but dependent on the market for food. How vulnerable households are to fluctuations in the food supply depends on a number of factors including whether they are net buyers or sellers of food, the stability of their income sources and how vulnerable they are to natural shocks (Adelman 1996).

### **Population and Urbanization**

#### **Population growth**

The United Nations estimates that approximately 80 million people will be added to the world annually during the next 25 years. Most of this increase is expected to occur in developing countries (Pinstrup-Andersen, Pandya-Lorch and Rosegrant 1997). Regional population numbers are expected to increase by 160 percent for sub-Saharan Africa between 1990 and 2025 compared to 107 percent in West Asia and North Africa, 56 percent in Asia, 59 percent in Latin America, and 60 percent in the world (Bongaarts 1995).

Sub-Saharan Africa poses a particular problem. Average population growth rates at 3 percent per year have outstripped the average growth rate in food production at 2 percent per year in the region (Mitchell, Ingco and Duncan 1997), and population growth is projected to continue to outstrip growth in food production. Projected population growth rates for the region are extremely high (2.8 percent) compared to world population growth rates of 1.5

percent per year between 1992 and 2005. In absolute terms, the population in sub-Saharan Africa is estimated to increase from 527 million in 1990 to over 700 million by 2005 (USDA 1995). It is projected that the number of people in sub-Saharan Africa will reach 1.3 billion by 2025 (Bongaarts 1995).

It has been argued that rising populations drive up the demand for food. Large population increases in developing countries may hinder efforts to improve per capita income, reduce poverty and increase the standard of living of the population (Pinstrup-Andersen 1994). High population growth rates put pressure on land resources. The growing demand on limited resources results in inappropriate cultivation practices, overgrazing and deforestation, and puts a strain on water supplies thus resulting in environmental degradation (Berck and Bigman 1993). The effect on the per capita food consumption and nutritional status of the population has adverse implications on labor and, hence, agricultural productivity and ultimately household incomes (USDA 1995). Consequently, rapid population growth is believed to reduce the impacts of gains from economic development on food security.

According to the World Bank (1989), high population growth results in food security problems and also has adverse effects in terms of education, urbanization and the environment. Increased poverty is considered to be one of the main factors associated with rapid population growth. In fact, it has been argued that population growth may be the cause of the poverty facing many developing countries and that a reduction in population growth rates may reduce poverty and, in turn, the prevailing food problems (Dasgupta 1995). Developing countries' ability to provide social services including education and health are greatly reduced. Furthermore, high population growth affects the international system by

increasing the economic disparities between the developed and developing countries and shifting the relative demographic size among nations. There are effects on dependency burden, nutrition and housing needs. It is considered to affect not only the quantity but also the quality of human capital investments. Institutional changes such as changes in the organization of the family, local community and forms of government administration may also result.

However, there are scholars who maintain that high population growth rates are not a problem since they stimulate technological advancement and promote economic development and higher living standards in the long run. Simon (1992) argues that positive population growth produces better economic performance in the long run (120 to 180 years) than does stationary population. In its *World Development Report*, the World Bank (1984) states that the interrelationship between development and population growth are not all fully understood. National differences in the economic, cultural, institutional and demographic setups influence the implications of rapid population growth in developing countries. Simmons (1988) also emphasized the importance of socio-cultural and institutional factors when studying the effect of population growth on economic development. Despite these arguments, the consensus remains that, at least for now, population growth poses a problem especially in the developing world and in terms of poverty, environmental degradation and food insecurity.

### **Urbanization**

Approximately 22 percent of the population in developing countries lived in urban areas in 1960. This increased to 31 percent in 1980 and is expected to rise to 44 percent by 2000 (Pinstrup-Andersen 1994). It is estimated that by 2025 the population of urban areas in

developing countries will increase from 1 billion to 4 billion (USDA 1996). Although, the focus of food insecurity has mainly been in terms of rural communities and problems, as urbanization increases more attention will be given to its implications on food insecurity (Phillips and Taylor 1991). Jaeger (1992), investigating the causes of food shortages in developing countries, found that among urbanization, government policies, declining world food prices and higher incomes, urbanization represented the strongest explanatory variable in determining increases in food imports for African countries<sup>4</sup>.

Increased urban populations place severe pressures on the food marketing and distribution systems and the physical infrastructure, including transportation, storage, processing, grading and market information (McCalla 1994). Urbanization and rising incomes increase the demand for food and change the pattern and composition of the demand for food. There is a shift in consumption patterns away from traditional staple food commodities and toward cereals which are usually imported. This is the combined result of national food pricing policies and overvalued exchange rates which make imported food commodities cheaper, and the high costs of marketing and distribution of domestic food commodities.

Urban migration implies a shift of labor resources out of agriculture and into the urban areas. Thus a rise in urbanization indicates lack of employment opportunities in the agricultural sector and may imply a reduction in agricultural production. As a result of the rural-to-urban migration, the rural labor supply in the food-producing areas declines while demand for imported food increases. The impact of urban migration on agricultural

---

<sup>4</sup> Jaeger (1992) used increases in food imports as evidence of Africa's chronic food problem.

production will depend on the elasticity of substitution between labor and non-labor inputs and the extent of the utilization of rural labor (Jaeger 1992).

## **Agriculture**

### **Agricultural development**

To achieve food security it is important for developing countries to implement policies that enhance economic growth, in general, and agricultural growth and productivity, in particular. Most developing economies depend on agriculture as the major source of income and employment. The agricultural sector is not only a supplier of food but also provides between 40 and 80 percent of employment and earns foreign exchange through the production of export commodities (Mellor 1992). Studies have shown that higher agricultural growth is positively correlated with higher economic growth. Furthermore, higher food (cereal) production has stronger positive effect on per capita calorie intake than does growth in the manufacturing sector (Cheng 1989).

However, during the 1950s and 1960s, the general development policies of most developing countries neglected agriculture. Resources were directed away from the agricultural sector to finance industrialization, the benefits of which were expected to trickle down to the poor. Industrialization was considered by many developing countries as a catalyst for growth and this process came at the expense of agriculture.

The movement toward the production of cash crops instead of food commodities is believed to have increased food security problems. Rural-to-urban migration increased, thus reducing urban wages, increasing unemployment and decreasing the rate of growth in grains. During the 1970s, two factors affected the food security situation in the developing world and led to an increase in poverty rates. First, the grain crisis led to a reduction in the food aid

required to meet the needs of the growing urban population in developing countries. Second, the oil crisis led to foreign exchange constraints that made it difficult for countries to import grains from the world market (Adelman 1996).

Agricultural growth is expected to not only increase production but also generate income through a rise in rural employment, as well as stimulate employment and income in non-agricultural sectors (Webb and von Braun 1994). Household assets also increase and this reduces their vulnerability to short-term income instability (von Braun et al. 1992). Hwa (1988) found that agricultural growth contributed to the overall growth of the economy through a rise in total factor productivity. Agricultural growth and increased agricultural productivity is expected to lead to growth in income and employment and better access to food, especially in the case of subsistence and small farmers. It is also expected to accelerate poverty alleviation and provide more equitable distribution.

According to the World Bank, developing countries that concentrated on broad-based agricultural strategies, especially in Asia, have been able to achieve improved levels of food security (Serageldin and Landell-Mills 1994). Although currently facing economic problems, Indonesia is cited as an example of a country, which gave high priority to increasing agricultural and food output. As a result, agriculture contributed to economic growth and the growth in food output exceeded the population growth rate. Consequently, Indonesia was able to achieve the highest daily per capita calorie supply (2,675 calories) compared to low-income countries. Indonesia also dramatically reduced its import of rice through rice self-sufficiency policies and increased rice consumption by keeping real prices of rice constant from 1974 to 1986. These policies reduced the number of poor and hungry in the country (Serageldin and Landell-Mills 1994). Kenya is considered to be another



example where emphasis on the growth of its agricultural sector during the 1980s lead to better food security for its people.

A study by Adelman and Berck (1991) examined development strategies for increasing food security in Korea in 1968 using a computable general equilibrium (CGE) model<sup>5</sup>. They found that agricultural development and export-led growth were the most effective food-security policies in reducing malnutrition with the former strategy dominating the latter. These strategies led to growth in GNP, higher mean incomes and higher income variances. Agricultural development also lead to increases in food consumption and it helped the manufacturing sector by freeing foreign exchange for import of machinery and intermediate inputs. Overall, agricultural development led to the lowest percentage of malnourished.

However, researchers have argued that policies in many developing countries have penalized rather than promoted agricultural development. Artificially low food prices targeting urban consumers, artificially high input prices such as fertilizer, overvalued exchange rates that make food imports cheaper and depress prices for local farmers all act as disincentives to agricultural producers. Public investments directed toward urban rather than rural areas have also discouraged farmers and depressed the creation of jobs in rural areas (IPC 1996).

Low taxation of agriculture has been associated with high agricultural growth. Taxation on agriculture has been lower in the East Asian economies compared to other developing countries and agricultural income and productivity has grown fastest in this region. Furthermore, East Asia's push for export-oriented production thus increasing the demand for

---

<sup>5</sup> Adelman and Berck examined a small, poor, open, negative balance-of trade, large food-deficit country. Although the results of simulations may vary depending on the type of economy and institutional specifications, they argue that their results of how individual programs affect different individual groups can be generalized.

labor, and public investment in infrastructure and basic social programs, education and health services also contributed to faster economic growth (Birdsall 1994).

It is important to point out that the policies of developed countries are considered to have also contributed to the global food problem. Export subsidies implemented in the developed nations have led to lower world food prices and further exacerbated the disincentives faced by farmers in the developing countries. Set-aside policies have shorted world markets. A study by the World Bank during the early 1990s estimated that a 50 percent reduction of trade protection by developed nations would increase export revenues to developing countries by US\$50 billion (Pinstrup-Andersen 1994).

#### **Science policy for agriculture**

Low agricultural productivity contributes to food gaps (difference between production and demand) and hinders income growth and lower food production costs. Research and policy is needed to deal with expected increases in risks resulting from weather factors, poor market structures, etc. (Pinstrup-Andersen, Pandya-Lorch and Rosegrant 1997). Agricultural research is also needed to prevent environmental degradation and resource depletion while increasing production. Crop yields need to increase since growth through the expansion of agricultural land is becoming increasingly difficult because of the scarcity of cultivatable land around the world (USDA 1995).

The World Bank (1986) argues that agricultural research and extension is needed to facilitate technological innovation and productivity growth. Technological progress in the form of modern inputs and biological and chemical innovations leads to higher productivity, better employment opportunities and increased income. Advancements in technology may lead to a reduction in the price of food and thus increase the real income of the poor. This in

turn helps improve the food consumption and nutrition of the poor. Technological improvements have resulted in reductions in production costs and increased global agricultural output (World Bank 1986).

Investment in rural infrastructure is also considered to be important in increasing agricultural growth and productivity. Improved infrastructure provides access to export and intracountry markets, modern inputs and consumer goods. It increases production and marketing efficiency and reduces marketing costs and price distortions (Pinstrup-Andersen 1994). One of the reasons that the Green Revolution was successful in Asia was the presence of good road networks for supplying inputs (USDA 1995).

Prior to the 1960s, research was concentrated on export crops that would earn foreign exchange and export tax revenue for developing countries. Most of this research was conducted under the International Agricultural Research Centers supported by the Consultative Group on International Agricultural Research (CGIAR). In 1960, with the establishment of the International Rice Research Institute (IRRI) in the Philippines, research began to focus on food crops and livestock.

Extension, input supply and infrastructure aimed at increasing yields, introducing new crops and expanding cultivated areas, were also initially geared toward specific export crops because it was believed that it was both technically simpler and more profitable to concentrate on only one or a few crops. Although this is changing, many countries continue to promote export crops over food crops. In Cameroon, for example, 25 percent of the allocations for investment in agriculture went to food crop production and agro-industry while more than 60 percent went to export crops in its 1976-1981 Plan. In the case of input supply and extension services, the focus in both Egypt and Chad was directed toward cotton

production. In Brazil, policies that favor the large-scale production of inputs for agro-industries and for exports have discriminated against small farmers who produce food crops. The use of modern inputs and mechanization has resulted in increased unemployment among farm labor.

There are also issues related to the transferability of agricultural technology. Some argue that one of the reasons that agricultural production in most developing countries has not increased sufficiently to meet domestic demands is that the technology was not appropriate for the vast majority of small farmers (Ruttan 1987). Furthermore, many have emphasized the importance of extension in transferring technology to farmers in marginal areas.

### **Historical trends**

Yields increased dramatically during the 1970s and 1980s accounting for 65 percent of the increase in global rice production, 80 percent of the increase in wheat production and 90 percent of the increase in the production of coarse grains. In addition, production increases during the Green Revolution have been improved not only through efficient use of inputs and enhanced crop yields but also through investment in infrastructure, higher farmgate prices, greater access to credit and improvements in agricultural extension. These technological advancements have kept world prices low.

Although the improvements of the Green Revolution have benefited Southeast Asia and parts of Latin America, they have bypassed the African continent (World Bank 1986). Unlike in Asia and Latin America where farmers had access to irrigation and markets, farmers in Africa worked on rainfed, marginal lands with fragile soils. These farmers were

unable to increase yields and, furthermore, had to compete with those who adopted the new technologies.

The advancements in agriculture over the past three decades have played a major role in reducing the percentage of hungry and malnourished people around the world from 35 percent in 1969-71 to 20 percent in 1990-92. Per capita food supplies increased from 2135 kilocalories per day to 2750 kilocalories per day (IPC 1996). Furthermore, investments in agricultural research have shown high rates of return during the 1980s and early 1990s, even in Africa (Webb and von Braun 1994). Investments in research have resulted in rates of return exceeding 35 percent in some cases (Pinstrup-Andersen 1994).

Even in Africa, countries that have invested in agricultural technology and reformed their policies have been able to increase economic and agricultural growth rates and food production. Mali has been able to achieve 8 percent agricultural growth in 1994 and 1995 and is now an exporter of some commodities. Other countries such as Senegal, Uganda, Tanzania, Ghana, Kenya and Guinea have also experienced positive growth rates in agriculture (USAID 1997).

Although expenditure in agricultural research doubled between 1970 and 1980 in developing countries, expenditure levels have stagnated since then. The annual growth rates in research investment declined in developing countries, especially in sub-Saharan Africa, Latin America and the Caribbean during the 1980s (ISNAR 1992). Many developing countries are now underinvesting in agricultural research. About 80 percent of aggregate agricultural research expenditure in developing countries is concentrated in 20 relatively large countries in Asia and Latin America (Binswanger and Landell-Mills 1995).

Thus, the rate of growth in global food production has slowed. Per capita food production declined in 35 developing countries during the period from 1980 to 1994, the majority in sub-Saharan Africa (USDA 1995). In order to increase agricultural production, developing countries need to raise the yield on arable land as less new land becomes available for production. This entails disease-resistant seeds and improved and balanced fertilizer and other crop protection chemicals and new production methods. These goals can only be achieved through agricultural research and development.

### **Access to land**

Most of the area expansion for agricultural production is expected to occur in developing countries, particularly in sub-Saharan Africa. This expansion, however, requires increased investments to improve the quality of the land with crop potential and to reduce the amount of land currently being lost to urbanization and environmental degradation. A major problem is that even the existing land currently available for agricultural production is not accessible to a significant number of rural households in developing countries.

According to von Braun et al. (1992), availability of land not only provides a source for food supply but also a source of employment and income for the rural population. At the micro-level, ownership or access to land has a significant effect on household food security. Food insecurity tends to be more prevalent among the landless poor. During the drought of 1982 in North Arcot, India, 73 percent of landless households were food deficient compared with 61 percent of households who owned land (von Braun et al. 1992).

Many of the small farmers in the developing world subsist on less than one hectare of marginal land. In many regions, particularly in Latin America, there is inequality in the distribution of landholdings and the trend seems to be worsening. The number of landless

populations has increased and this implies that these populations are vulnerable to food insecurity. In countries where policies of land reform were implemented, such as in the Republic of Korea and in China and Taiwan, improved land distribution contributed to significant agricultural growth and improved food security (Alamgir and Arora 1991).

### **Terms of trade**

Evidence shows that liberalization of agricultural policies and markets tend to lead to growth in the agricultural sector which in turn increases rural income (example, China during the late 1970s). Countries, particularly those in Africa, which do not have liberal agricultural policies have faced food shortages, widespread malnutrition and even famine. Liberalizing agricultural policies and providing incentives to agricultural producers would lead to an increase in domestic production of agricultural commodities for which they have a comparative advantage and increase rural incomes. Thus more people would have the ability to purchase food and countries would be able to import food at the national level.

In many developing countries hunger and poverty are most prevalent in the rural areas. Government policies in the form of overvalued exchange rates, industrial protection policies, allocation of public expenditure and some trade policies have taxed the agricultural sectors as a result of urban bias. Urban bias has also directed investments in infrastructure around the urban centers. Poor infrastructure and transportation, particularly in the rural areas, have resulted in high transport costs and market uncertainties. This has increased the price of crops produced and the difficulty in getting them to market.

### **Overvalued Exchange Rate**

Many low-income countries in the developing world have overvalued exchange rates, partly to keep food prices low in order to maintain low nominal wages and partly as a result

of high protective barriers to benefit import-substituting industries. The overvalued exchange rate is equivalent to an export tax and to an import subsidy. Since most developing countries export primarily agricultural commodities, this export tax is a bias against the agricultural sector. It acts as a disincentive to the production of agricultural exports and domestic food production competing with imported foodstuffs (Alexandratos 1988).

Imports are also much higher than with exchange rates closer to equilibrium. This results from a higher domestic price and lower real prices of food imports. Overvalued exchange rates also lead to a misallocation and inefficient use of resources which leads to slow economic growth. The prices of tradable goods are lower relative to nontradable goods (World Bank 1986).

#### **Access to Credit**

Household food security can be improved through access to credit that would stabilize consumption and promote self-employment. However, the majority of institutional credit in developing countries is available mostly to the large and medium farmers producing agricultural commodities for the market. No more than 25 percent of smallholder credit needs are provided through institutional lending. Lack of collateral, illiteracy and poor repayment rates are cited among the main reasons why the rural poor are unable to acquire credit from traditional banking institutions. This inaccessibility to formal credit channels forces poor farmers to resort to informal sources of credit with very high costs that further exacerbate their food insecurity (Alamgir and Arora 1991).

One example of the success of programs giving access to small-scale credit to the poor is the Grameen Bank which provides interest-bearing credit without collateral. This has facilitated the accumulation of capital by the poor and generated new employment. The



resulting increase in income leads to increase in absolute expenditure on food consumption (von Braun et al. 1992). Agricultural producers also need credit for modern inputs.

### **Education**

Researchers argue that agricultural production needs to increase in order to raise per capita food consumption and improve the standard of living. Agricultural production can benefit from basic education (literacy and numeracy education) which can significantly improve the efficacy of training and agricultural extension work. This may enhance the productivity of inputs including labor; reduce the costs of acquiring and using information about production technology that can increase productive efficiency; and facilitate entrepreneurship and responses to changing market conditions and technological developments. Studies have shown that years of education are positively related to higher agricultural productivity (Alexandratos 1995).

Although public expenditure on education increased in developing countries, this increase has not been uniform across the developing world. In sub-Saharan Africa and Latin America and the Caribbean, expenditure on education declined during the 1980s. Despite the overall improvement in education expenditures, there still exist a large number of illiterate adults, particularly in the rural areas of developing countries (Alexandratos 1995).

### **Export Earnings**

The ability of many low-income, food-deficit countries to generate income from agriculture, as well as export revenues to import food, depends on their relative international competitiveness in agriculture. Trade in agricultural commodities enhances rural incomes, and therefore the ability to buy food (Binswanger and Landell-Mills 1995). Many developing countries do not have access to world markets to sell their export commodities.

Trade barriers are erected by developed countries preventing developing countries from selling their export goods and therefore the ability to finance food imports. Furthermore, many developing countries, particularly African countries, face plummeting world prices for key agricultural commodities thus reducing export earnings. In contrast, prices of essential commodities such as oil have increased.

The ability to import food allows countries to meet the needs of their population thus lowering the cost of food to consumers and freeing resources to more efficient uses. Net grain imports in developing countries are projected to increase from 87 million tons in 1990 to 210 million tons by 2010 (Mitchell, Ingco and Duncan 1997). Without export earnings, developing countries are not able to generate the necessary foreign exchange to import food. The allocation of scarce foreign exchange to food imports during food shortages results in destabilization of import of investment goods. This has an adverse effect on the economy (von Braun et al. 1992). Constraints in foreign exchange affects food insecurity as it influences the amount of food imports a country can purchase in the world market at the expense of non-food imports and their effect on economic development (Green and Kirkpatrick 1982; Kirkpatrick and Diakosavvas 1985).

### **Food Aid**

It has been debated that food aid may have some negative impact on developing recipient countries such as distortion of domestic markets thus exacerbating food problems. During the 1960s, food aid made up a large part of import needs in developing countries, which gave low priority to agriculture as a result. Food aid also acted as a disincentive to farmers as it affected local food prices and resulted in a shift in consumption patterns from traditional crops to imported crops (for example, wheat in sub-Saharan Africa).

Food aid has also been used to support inadequate agricultural policies by recipient countries such as food price subsidies which have been argued to inhibit the growth of domestic food production in the short run and misallocation of resources in the long run. This makes developing countries dependent on food aid. According to the World Bank, food aid does not help countries cope with food insecurity resulting from rising international food prices. When food prices are higher in the international market, less food can be purchased on fixed budgets for food aid. Budgets for food aid are also often reduced when prospects for commercial exports improve. Food aid also does not tend to reach the poorest and the neediest segments of the developing nations.

Adelman and Berck (1991) found that food aid is not effective as a strategy for eliminating food insecurity. In fact, they concluded that without appropriate measures to reduce its adverse effects, food aid is “an overall food-security disaster, though it does help a few urban groups” (Adelman and Berck 1991, 49).

However, some empirical studies have not been able to support these claims. Examples of countries that were major food aid recipients but no longer are include India, South Korea and Taiwan. These findings argue that the disincentive effects of food aid on agriculture are not so pronounced. The effects of food aid depend on food and agricultural policies implemented by recipient countries. Policies must be put in place to reduce or eliminate the potential disincentive effects of food aid (von Braun 1992). Furthermore, food aid can be used to increase human capital formations by improving nutrition and as an incentive to participate in formal schooling and training programs without having significant disincentive effects on agricultural production.

### **External Debt**

During the 1970s, many countries in the developing world borrowed money from foreign creditors. Most of these loans were not spent on income-generating activities. About 15 to 20 percent went into military expenditures while the rest was lost to unproductive projects, corruption and importing consumer goods. By the early 1980s, many governments were unable to service their debts and turned to the International Monetary Fund (IMF) for credit. In order to obtain IMF funding, developing countries had to implement structural adjustment policies that adversely affected the poor. Reductions in public expenditure, consumption and subsidies, the higher domestic prices resulting from devaluation of domestic currencies and the movement away from staple food production and toward export production all contributed to the decline in the welfare of the poor. Wages declined, unemployment increases, and malnutrition and infant mortality rose (Collins 1991).

Countries need export surplus to service their debts. This reduces their capacity to import food particularly if export earnings are insufficient or decline and demand for food imports increases. Thus, developing countries with high external debts become increasingly vulnerable to food insecurity when faced with production or export shortfalls, or rising import prices (Alamgir and Arora 1991).

### **Political Participation**

The relationship between food security and the political structure in developing countries has not been studied extensively. One hypothesis that may be investigated as a source of food problems in developing countries is the effect of political institutions on economic growth and agricultural development. Political institutions, in the form of

political, civil and economic rights, have been ignored when explaining economic development until recently.

Political systems and institutional setups are generally assumed as given in studies determining economic growth. However, according to Sen (1994a), political rights are crucial both in “inducing political responses to economic needs” and in “the conceptualization of economic needs” (36). The following chapter examines the issue of political institutions and their link to economic growth in general and attempts to provide a link to food problems in particular.

## CHAPTER 4. THE ISSUE OF POLITICAL INSTITUTIONS

### Political Institutions and Economic Growth

#### Theoretical perspective

Adelman and Hihn (1984) provide a review of theories of change in political structures and economic development. Classical modernization theory argues that economic development leads to equality, stability and democracy<sup>6</sup> while contemporary modernization theory argues that the high correlation between economic development, equity and political participation is seen only in highly developed economies. Classical Marxist theory considers class conflict as the catalyst for economic and political change. Contemporary Marxists concentrate on the interactions of external and internal effects on political and economic change. Some contemporary political scientists believe that “historical sequencing of political competition and political inclusiveness” determine political systems and that these systems are affected by factors such as the current socioeconomic structure, the level of development, the degree of inequality and international influences (Adelman and Hihn 1984, 2).

A bureaucratic-authoritarian model argues that slow economic growth may lead to political change through coalition between the educated technical elite and the military, as is the case in Latin America. A change-agent theory proposes that groups ranked according to economic, political and social status may experience rank disequilibrium if they do not have

---

<sup>6</sup> According to Bollen (1980), there has been some debate on the theoretical definition of political democracy. He reviews some of the definitions of democracy and offers a definition of political democracy as “the extent to which the political power of the elite is minimized and that of the nonelite is maximized (Bollen 1980, 372).

the same rank on all three scales. To achieve rank equilibrium the group or groups bring about economic and political change (Adelman and Hihn, 1984).

Olson (1993) provides an interesting theory based on the assumption of rational self-interest to explain both democracy and autocracy. In order for a society to function satisfactorily, it requires peaceful order and other public goods. For this reason autocracy is preferred to anarchy. A rational self-interested autocrat provides security from theft and other public goods to the society as an incentive for the society to produce. The autocrat then extracts production surpluses by imposing a revenue-maximizing tax rate on his society. The time horizon of the autocrat is an important consideration as autocrats with short planning horizons tend to confiscate wealth, expropriate assets and revoke contracts, a disincentive for production which reduces income and tax collections.

When comparing democracy and autocracy, Olson assumed that leaders in a democratic society are also motivated by self-interest and avoids a better motivation as an objective of democracy so that democracy is not given an unfair advantage over autocracy. Democratic leaders try to “buy” majority votes by transferring income from the general population to the prospective majority. However, in this case the optimal tax rate is lower than the revenue-maximizing tax rate of the autocrat as income will be maximized with a lower tax rate and a smaller redistribution of output. Thus, a democratic system prevents its leaders from significant extraction of social surplus. In terms of individual rights to property and contracts, Olson states that “the conditions necessary for a lasting democracy are the same necessary for the security of property and contract rights that generates economic growth” (1993, 567). According to Olson, good economic performance in autocratic systems does not

last for more than two generations while stable democracies have been able to maintain good economic performance across generations.

Broadly speaking there are two schools of thought in terms of the relationship between democracy and economic growth. Some argue that democracy hinders economic growth while others argue that democracy enhances economic growth. Opponents of democracy argue that developing countries cannot achieve economic growth through a democratic framework since democracy and economic growth are competing goals. Rapid economic growth requires an authoritarian government to deal with the “problems of nation-building, to contain discontent, and to control domestic pressures” (Sirowy and Inkeles 1990, 130). To facilitate economic growth, authoritarian rule can curb consumption and increase savings and investment. The authoritarian state can also insulate itself from private pressures.

Advocates of democracy argue that authoritarian regimes are inefficient and do not maximize output (Przeworski and Limongi 1993). Democracies stimulate sustained and equitable growth, broaden markets and motivate citizens to save and invest (Sirowy and Inkeles 1990). Authoritarian governments may also have the tendency to steal the nation’s wealth and make nonproductive investments (Barro 1997).

### **Studies on political institutions and economic growth**

A number of studies look at the relationship between democracy and economic growth/development (Weede 1983; Scully 1988; McMillan, Rausser and Johnson 1993; Barro 1997). Sirowy and Inkeles (1990), and Przeworski and Limongi (1993) provide a summary of other studies on democracy and economic growth and a review of the arguments for and against democracy and its effect on economic growth.



Weede (1983) concluded that when both developed and less-developed countries are studied together political democracy has a negative but weak effect on economic growth. He argues that while this may not be the case for all countries, in countries where the economy is controlled by the state, political democracy hinders economic growth. Scully (1988) compared the institutional framework, measured in terms of political, civil and economic liberties to compound growth rates of real domestic product per capita for 115 countries and found that the choice of the institutional framework had significant and large effects on economic efficiency and growth. "Politically-open" countries grew at three times the rate and were two and one-half times as efficient as "politically-closed" countries.

McMillan, Rausser and Johnson (1994) found that higher and sustained economic growth can be achieved through institutional, constitutional and policy changes. These, in turn, lead to improved political and civil rights. Barro (1997) found a nonlinear relationship between democracy and economic growth where democracy increases growth in countries with weak political freedoms, but hinders growth in countries with moderate freedoms. Both Sirowy and Inkeles (1990), and Przeworski and Limongi (1993) reviewed studies that arrive at one of three conclusions: a negative relationship between economic growth and democracy; no relationship between the two; and a qualified or conditional relationship.

Some studies attempted to examine variables other than economic growth and/or democracy. Deaton (1993) looked at the relationship between world prices of primary commodity exports and the survival of leaders in Africa. On the premise that world prices are not affected by domestic political events in most African countries and that they affect GDP, the study found that economic growth helps leaders remain in power so that the direction of causality was from economic growth to political survival.

Fosu (1992) looked at the effect of institutional stability on economic growth in sub-Saharan African countries and concluded that political instability has a negative effect on economic growth. It decreased the marginal productivity of capital and exports. Results also gave some indication of negative effects on capital, labor and export quantities. For countries with high political instability, annual GDP growth was reduced by an average of 33 percent of the mean annual GDP growth rate of 3.37 percent for a sample of 31 sub-Saharan African countries for the period between 1960 and 1986. Fosu concluded that political instability in developing countries might have contributed greatly to their stagnating economies and the low or declining growth rates of their GDP.

Thus, many of the studies show an association between economic growth and democracy or political and civil rights. The difficult question lies in the direction of causality. Does higher economic growth result in more rights or vice versa? According to Deaton (1993), results from earlier studies have proven to be inconclusive in determining the direction of causality. Barro summarized the result of the various studies as “the net effect of democracy on growth is theoretically inconclusive” (Barro 1997, 33). Przeworski and Limongi (1993) arrive at the same conclusion.

### **Political Institutions and Food Insecurity**

Food insecurity has important political dimensions. Poverty is the root cause of food insecurity and the participation of the poor in the political process is weak. According to Maxwell (1997), achieving food security is a political matter in addition to being a technical matter. To eliminate poverty and therefore food insecurity, governments need to provide the poor with access to economic and social opportunities. These opportunities are “ultimately

issues of the functioning of political systems” (Walters and Bissell 1994, p. 131). Political accountability and political freedom give the public some influence on reform decisions.

Public action, in the form of governmental initiatives and public participation, is a critical factor in eliminating persistent hunger and famines. “The demand for action through political activism, journalistic pressures, and informed criticism can help to identify both persistent hunger and famine risk” (Webb and von Braun 1994, p. 207). Countries with more pluralistic politics and open channels of communication and criticism have been more successful in preventing famine than countries where political opposition and free speech were limited or non-existent. However, democracy is vulnerable in countries with high external debt, disease, hunger and poverty (Webb and von Braun 1994).

According to Sen (1994b), hunger exists because of failure of entitlement by the poor, i.e., their inability to establish command over adequate food and other essentials. Thus famines exist during adequate to high food availability. Governments in many developing countries often do not act quickly to prevent famines because they do not have to face reelection. Democracy and free press are critical in bringing forth the effects of starvation, disease and death during famines and pressuring the government into action.

Sen (1994b) argues that this is the reason a famine has never occurred in a democratic (developed or developing) country with a free press. For example, democratic countries such as Botswana and Zimbabwe were able to avoid famines during the early 1980s, while non-democratic Sudan and Ethiopia did not, even though Botswana and Zimbabwe faced much higher food shortages. The democratic systems in Botswana and Zimbabwe made it imperative that their governments implement timely and extensive famine prevention policies in order to avoid harsh criticism from opposition parties (Sen 1994a).

With democracy and free press, people are able to become politically active in influencing public policy. However, the issue is more complex in terms of reduction or elimination of endemic hunger. For example, China made dramatic improvements in the elimination of endemic undernutrition but was unable to avoid famine in the late 1950s. Democratic India, on the other hand, has avoided famine although endemic undernutrition still exists. One explanation is that endemic undernutrition is not as visible as the effects of famine on populations and therefore governments are not as pressured by free press and the politically active to act (Webb and von Braun 1994).

In terms of the reduction of poverty, countries where the elite have political as well as economic power tend to implement policies that are likely to favor the elite (Birdsall 1994). A democratic distribution of economic power via access by the poor to food-producing and income-generating resources is crucial in terms of eliminating hunger. Thus a strategy of increasing food production through technology without taking into consideration who owns the productive resources may adversely affect the poor. In India, for example, the Green Revolution increased the productive capacity of the land, thus, benefiting the well-to-do farmers who controlled the land. This increased the value of the land by three to five-fold within a few years. As a result, rents increased and the tenant farmers were pushed off the land, doubling the number of landless in the twenty years following the introduction of "Green Revolution" technology. Although food production increased, the number of undernourished also rose (Collins 1991).

Population growth rates may also be influenced by the political structure. According to Collins (1991), "rapid population growth is rooted in economic insecurity generated and perpetuated by antidemocratic power structures. Indeed, rapid population growth can

perhaps best be understood to result largely from efforts by the poor to cope in the face of the concentrated economic power of the elite” (p. 357). The rural poor have a large number of children to enhance their incomes through work in agricultural and other economic activities. For this reason, poverty and high population growth often occur together. Given political rights and civil liberties, people are able to acquire control over economic resources and therefore, to access food through either production and/or purchase.

Another dimension in the question of democracy and political rights is the issue of urban bias. Political pressure by the urban consumer to keep food prices low because of low wages, and the high cost of collective action by farmers in developing countries have resulted in the taxation of agriculture. According to Bates (1981), agricultural policy consequently becomes a byproduct of political relations between governments and urban populations. Governments also use the market as a basis for political control. In many African countries, the purchase and export of agricultural commodities is controlled by public monopsonies and marketing agencies. Farmers are paid lower prices for their agricultural products and domestic prices are kept low.

The agricultural sector is also taxed because its exportables are a major source of income in many developing countries given the lack of alternative tax instruments. As countries become more developed and wages increase, the governments face less political pressure to keep food prices low and a smaller farming population becomes more organized and able to exert political pressure (Beghin and Kherallah 1994). A study by Beghin and Kherallah (1994) shows that political systems influence agricultural protection levels nonlinearly. Agricultural assistance is most prominent in dominant party systems, becomes non-increasing as systems become more democratic and then rents tend to dissipate under the

most democratic systems. Foreign assistance, particularly in the form of food aid, also depends to some extent on the political structure of the recipient country. In 1981, the World Bank acknowledged that it was difficult to provide aid to some countries because of their political situations.

Judd, Boyce and Evenson (1986) found that several factors affect the allocation of resources to research and extension including institutional barriers such as high prices of national scientific resources and political factors. It has been shown that countries which have a large proportion of their population in the agricultural labor force invest less in research and extension. Also, most of the agricultural research is concentrated on traded commodities rather than nontraded commodities. This underinvestment is related to political influence and a lack of awareness of potential benefits. Much of the agricultural population in developing countries is comprised of small farmers, food producers and agricultural laborers. Most of the political power lies with the urban population and thus the rural sector has little influence especially in terms of expenditure in research and extension programs. This has resulted in a bias against investment in agricultural research and technology which, in turn, has a significant negative impact on productivity in the agricultural sector and ultimately on food security.

Dasgupta and Weale (1992) ranked low-income countries according to national income per capita, life expectancy at birth, infant survival rate, adult literacy rate and, political and civil liberties using the Borda Rule as an aggregator. They compared improvements in socioeconomic performance with the presence of the political and civil liberties. They found that there was a positive and significant correlation between political and civil liberties and national income per capita, improvements in infant survival rates and increases in life

expectancy at birth. However, a surprising outcome was that increases in the adult literacy rate are negatively and significantly correlated with political and civil liberties.

In terms of food, the extent of the power relationships exercised by the government, agro-industry and market forces influence production decisions which, in turn, influence the entire food chain. Thus, government policy decisions concerning food are not only affected by production, consumption and trade considerations but also the political power of the producers, consumers and other groups (van de Walle 1992).

## CHAPTER 5. DESCRIPTION OF THE VARIABLES

This study provides an empirical analysis of the causes of chronic food insecurity. A cross-sectional econometric model is used. The purpose of the study is to establish stylized facts about the influence of political institutions on the indicator of food security as measured by per capita dietary energy supply. The empirical analysis attempts to assess the relative importance of the independent variables in explaining the differences among countries for a given indicator of food insecurity. Thus, the indicator of food insecurity is regressed on selected economic and social variables.

According to the FAO, the majority of food-insecure (undernourished) people live in South and Southeast Asia and sub-Saharan Africa, followed by East Asia, Latin America and the Caribbean and the Middle East and North Africa (FAO 1996)<sup>7</sup>. In order to make comparisons among countries with varying degrees of food security and food insecurity, the study covers both developed and developing countries. The data are for the period 1975, 1985 and 1995. The following section discusses some of the model variables and why they were selected.

### Discussion of Some of the Model Variables

#### Dependent variable

The number of food-insecure people in the world has been estimated using different methods. One of the most common measures of food insecurity<sup>8</sup> is the "number of people

---

<sup>7</sup> The method by which the FAO measures chronic undernourishment, an indicator of food insecurity, has been criticized as methodologically biased toward national food availability and does not adequately account for the problem of access to food (Smith 1997).

<sup>8</sup> Here, Bigman (1993) is referring to food insecurity under a stable food supply. The measure of food insecurity under instability is given as the probability that food consumption of the poor falls below a specific critical level, i.e., minimum subsistence level or a fraction of that level.



whose food consumption falls below a predetermined minimum level which is deemed necessary for good health” (Bigman 1993, 238). However, this measure of food insecurity does not take into account the interpersonal variations in food consumption due to inequalities in income distribution nor does it indicate the depth of the gap between actual and minimum consumption levels. Furthermore, this measure ignores the effects of temporary food shortages in food availability that affects both the numbers and the extent of undernourishment (Bigman 1993).

Countries with widespread food security problems are determined by looking at several indicators including low average levels of calorie consumption (below 2100 kilocalories per capita), levels of and large fluctuations in food consumption, and large numbers of absolute poor (von Braun et al. 1992). A study by the Food and Agriculture Organization of the United Nations (FAO) determined the number of undernourished at a certain basal metabolic rate (BMR) level. The World Bank looked at the number of people who did not have enough income to obtain a minimum calorie diet that would prevent serious health risks and stunted growth (estimated at 340 million in 1980) and the number of people who did not have enough income for food to live an active working life (estimated at 730 million in 1980) (World Bank 1986).

A study by the International Food Policy Research Institute (IFPRI) examined calorie-consumption information to determine the number of calorie-deficient people in developing countries. Per capita food consumption is also used as an indicator, albeit poor, of the number of people with inadequate diets. However, these estimates give an approximate indication of the incidence of food-energy deficiency among the poor and not of food insecurity. They do not take into account fluctuations and risks in the availability of and

access to food (von Braun et al. 1992). Furthermore, the measurements are made with the optimistic assumption that income distribution has remained the same during the period under study.

### **Political variables**

Political rights and civil liberties compiled by the Freedom House will be used as measures of democracy<sup>9</sup>. Political rights are defined as the rights which “enable people to participate freely in the political process” and the index looks at free elections of officials, the right to organize and reasonable self-determination among other things. Civil liberties are “the freedoms to develop views, institutions and personal autonomy apart from the state” and the index includes freedom of the media and open discussion, freedom of assembly and political organization and freedom from persecution (Ryan 1995, 672)<sup>10</sup>. The political process is the system by which people can elect authoritative policy makers and can make decisions on public policies through their elected representatives. Bollen (1980) argues against the indiscriminant use of indicators for political instability, voter participation, socialist party strength or labor union strength in the construction of political democracy. He contends that, although these concepts are important in their own right, their inclusion in the political democracy index has led to conflicting results in a number of empirical studies.

Political rights and civil liberties are each rated on a seven-category scale with 1 representing the most free and 7 representing the least free. Countries are also placed in three broad categories based on the average category numbers for both political rights and civil liberties. An average between 1 and 2.5 is considered “free”, between 3 and 5.5 “partly

---

<sup>9</sup> Bollen (1990) discusses the problems surrounding the definition and measurement of political democracy.

<sup>10</sup> Gastil (1990) and Ryan (1995) offer a comprehensive discussion on the checklists used to rate countries according to political rights and civil liberties.

free” and between 5.5 and 7 “not free” (see Appendix A for the checklist used by Freedom House to rate political rights and civil liberties).

The use of ordinal rankings as continuous variables presents econometric difficulties and one solution is to transform the continuous variable into a set of dummy variables corresponding to high, medium and low levels of freedom (Scully 1988). Scully (1988) found that the inclusion of all the political variables (political rights, civil and economic liberties) into the model presented some multicollinearity and that separability of rights is relatively weak. Instead of using political rights and civil liberties indices separately as measures of democracy, an appropriate option would be to use the sum of the indices such that they jointly range from 2 to 14 (Murdoch, Sandler and Sargent 1997). We can then define three dummy variables to represent the countries that are free, partly free and not free (Murdoch and Sandler 1997; Murdoch, Sandler and Sargent 1997).

### **Economic variables**

Food security is affected by government intervention and the extent to which governments impose constraints on the production, distribution and consumption of goods and services. One measure that incorporates a number of economic factors that reflect government intervention is the index of economic freedom. Individuals enjoy economic freedom if they are not constrained by their governments in terms of production, distribution, or consumption of goods and services (Johnson, Holmes and Kirkpatrick 1998). The economic factors taken into account when measuring the index of economic freedom include trade policy; taxation; government intervention in the economy; monetary policy; capital flows and foreign investment; banking; wage and price controls; property rights; regulation; and black market (see Appendix B for a detailed explanation of these factors).

The index of economic freedom ranks countries according to their level of economic freedom. The ten factors taken into account are treated as equally important, i.e., they are assigned an equal weight. Johnson, Holmes and Kirkpatrick (1998) argue that there is not sufficient scientific support to treating some economic factors as more important than others and that, for long-term economic growth, a country must perform well in all the ten factors included in the index.

An overall economic freedom score is given to each country of the 187 countries studied by averaging the ten individual factor scores with each factor being scored according to its own unique grading scale. The scores range from 1 to 5. A country is economically free if it achieves an average overall score of 1.99 or less; mostly free if the score is between 2.00 and 2.99; mostly not free if the country has a score between 3.00 and 3.99; and repressed for a country with an average overall score of 4.00 or higher.

The study also looked at economic freedom indices as measured by the Freedom House for 82 countries. In this case, the index measures the extent to which governments prevent their citizens from exercising their right to own property, earn a living, operate a business, invest their earnings, trade internationally, and participate equally in all aspects of the market economy (see Appendix C for a detailed description). A country must also have a legal and institutional framework within which market transactions can occur.

The scoring scale for the freedom to trade internationally and the freedom to participate equally in all aspects of the economy range from 0 to 2, where 2 is the greatest degree of freedom and 0 is little or no freedom. The rest of the indicators have a scoring scale ranging from 0 to 3 with 3 being the most free and 0 being not free. Thus, countries with a score of 13 or more are rated as "free", a score between 10 and 12 rates a country as "partly free",

countries rated between 7 and 9 are “mostly not free”, countries with a score of 6 or less are considered “not free” (Messick 1996).

Although the Freedom House index used different indicators than the Heritage Foundation index, the ratings of these foundations are very similar. However, there are two exceptions to this. Singapore was rated as free by the Heritage Foundation but partly free by Freedom House that concluded that while Singapore encourages foreign investments, its citizens do not enjoy full economic freedom. South Africa was given a mostly not free rating by the Heritage Foundation but a free rating by Freedom House as the latter’s indicators pointed to opportunities for individual economic advancement. Since data is available for more countries, this study uses the index of economic freedoms as measured by the Heritage Foundation.

#### **Description of the Data**

Based on the discussions presented in the preceding chapters, the description of the dependent variable and the explanatory variables included in the analysis are presented in this section. Most of the data used in this study was obtained from The World Bank’s *1998 World Development Indicators* database (World Bank 1998) which is comprised of annual time-series data for developed and developing countries from 1960 to 1996. Daily dietary energy supply per capita, the dependent variable used an indicator of food insecurity, was obtained from FAO’s *The Sixth World Food Survey* (FAO 1996) and from the *FAOSTAT Statistical Database* (<http://apps.fao.org>) on the World Wide Web. Table 5.2 lists the variables used in the analysis and their definitions. Appendix D provides the descriptive statistics of the regression variables and information on the data used.

Table 5.2. Definition and source of variables

Variable	Definition	Source
Arable land (hectares per person) (LAND)	Land under temporary crops, temporary meadows for mowing or pasture, and land under market and kitchen gardens.	World Bank <sup>a</sup>
Cereal production (metric tons) (CEREAL)	Cereals include wheat, rice, maize, barley, oats, rye, millet, sorghum, buckwheat, and mixed grains. Production data on cereals relate to crops harvested for dry grain only. They exclude cereal crops harvested for hay or harvested green for food, feed, or silage and those used for grazing.	World Bank <sup>a</sup>
Economic freedom (HECF)	See section on "Discussion of some of the model variables" in Chapter 5	Heritage Foundation <sup>b</sup>
Export growth (%) (XGRT)	Average growth of export of goods and services (1991-1995). Exports of goods and services represent the value of all goods and other market services provided to the world. Included is the value of merchandise and non-factor services.	World Bank <sup>a</sup>
External debt (EDEBT)	Total external debt per capita in current US dollars	World Bank <sup>a</sup>
Female enrollment (FEMP)	Female enrollment ratios in primary school as a percentage of men	World Resource Institute <sup>c</sup>
Fertility rate, total (births per woman) (FRATE)	Represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with prevailing age-specific fertility rates.	World Bank <sup>a</sup>
Fertilizer consumption (100 grams per hectare of arable land) (FERTC)	The quantity of plant nutrients used per unit of arable land. Fertilizer products cover nitrogenous, potash, and phosphate fertilizers (including ground rock phosphate). The time reference for fertilizer consumption is the crop year.	World Bank <sup>a</sup>
GDP growth (%) (GDPGRT)	Average growth rate of real GDP per capita (constant 1987 US dollars) 1991-1995	World Bank <sup>a</sup>
Gini Coefficient (GINI)	Measures inequality in the distribution of income	Deininger and Squire <sup>d</sup>
Government consumption (% of GDP) (GCON)	General government consumption (1991-1995)	World Bank <sup>a</sup>
Gross domestic investment (% of GDP) (GINV)	Average gross domestic investment as a percentage of GDP (1991-1995)	World Bank <sup>a</sup>
Gross Domestic Product (GDP) per capita, PPP	Gross National Product (GNP), purchasing power parity, current international prices	World Bank <sup>a</sup>
Literacy rate, adult total (% of people 15+) (LIT)	The proportion of adults aged 15 and older who are literate	World Bank <sup>a</sup>
Inflation (average rate) (AVGINF)	Average growth rate of GDP deflator (1987=100) (1991-1995)	World Bank <sup>a</sup>
Irrigated land (% of arable land) (IRRIG)	The area purposely provided with water, including land irrigated by controlled flooding.	World Bank <sup>a</sup>

Source: <sup>a</sup> 1998 *World Development Indicators CD-ROM*, The World Bank (World Bank 1998); <sup>b</sup> 1999 *Index of Economic Freedom*, The Heritage Foundation (Johnson, Bryan T., Kim R. Holmes and Melanie Kirkpatrick 1998); <sup>c</sup> World Resources Database 1996-97; <sup>d</sup> Deininger and Squire 1996; <sup>e</sup> UNESCO Statistics Database 1999; <sup>f</sup> *The Sixth World Food Survey*, FAO (FAO 1996); <sup>g</sup> *World Survey of Economic Freedom*, The Freedom House (Messick 1998); <sup>h</sup> United States Department of Agriculture, Economic Research Services, 1998.

Table 5.2. (continued)

Variable	Definition	Source
Labor force growth (%) (LABFRC)	Average growth rate of the labor force (1991-1995)	World Bank <sup>a</sup>
Labor force in agriculture (%) (AGLAB)	The proportion of the total labor force recorded as working in agriculture, hunting, forestry, and fishing	World Bank <sup>a</sup>
Military expenditure (% of GNP) (MILEXP)	Military expenditure as a percentage of GNP	World Bank <sup>a</sup>
Official development assistance and official aid (US\$) (ODA)	Official development assistance (ODA) consists of net disbursements of loans and grants made on concessional terms by official agencies of the members of DAC and certain Arab countries to promote economic development and welfare in recipient economies listed as developed by DAC. Loans with a grant element of more than 25 percent are included in ODA. ODA also includes technical cooperation and assistance. Official aid refers to aid flows from official donors to the transition economies of Eastern Europe and the former Soviet Union and to certain advanced developing countries and territories as determined by DAC. Official aid is provided under terms and conditions similar to those for ODA.	World Bank <sup>a</sup>
Per capita cereal consumption (CEREAL)	Total cereal consumption excluding beer supply/cap/year (kg)	FAO <sup>i</sup>
Per capita dietary energy supply (DES)	Total food availability estimates obtained by aggregating the energy or nutritive values of the food component of commodities available for human consumption	FAO <sup>f</sup>
Political rights and civil liberties (PRCL)	See section on "Discussion of some of the model variables" in Chapter 5	Freedom House <sup>g</sup>
Population, total (POP)	Based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. Refugees not permanently settled in the country of asylum are generally considered to be part of the population of their country of origin.	World Bank <sup>a</sup>
Primary school enrollment ratio (%) (PRIM)	Primary school enrollment (% gross) in 1991	World Bank <sup>a</sup>
Secondary school enrollment (%) (SEC)	School enrollment, secondary (% gross) in 1991	World Bank <sup>a</sup>
Trade (% of GDP) (TRADE)	Trade is the sum of exports and imports of goods and services.	World Bank <sup>a</sup>
Urban population (% of total) (UPOP)	The midyear population of areas defined as urban in each country. It is measured as the percentage of the total population.	World Bank <sup>a</sup>

### Choice of Data Sources

The decision to use the data sources and the variables provided in Table 5.2 was made after an extensive search for data. In addition to the data sources listed, data from the World Health Organization (WHO), United States Department of Agriculture (USDA), Central Intelligence Agency (CIA), and United Nation Children's Fund (UNICEF) among others were considered. Table 5.3 shows the some of the data sources and variables that were reviewed. The decision to use the World Bank for most of the data was two-fold: (i) the desire to keep the data as consistent as possible in terms of country definitions, variables definitions, etc., and, (ii) the completeness of the data.

**Table 5.3. Data sources and variables considered**

<b>Data Source</b>	<b>Variable</b>	<b>Decision</b>
World Bank	Gini coefficient	Data from Deininger and Squire, 1996 was more complete
	Poverty index	Not available for many countries
Penn World Tables	Gross Domestic Product	World Bank data available
WHO	Prevalence of underweight	FAO's per capita dietary energy supply includes more countries
UNICEF	Malnutrition	FAO's per capita dietary energy supply includes more countries
CIA World Factbook	Literacy rates, external debt, foreign and food aid	Data for different countries given for different years – World Bank data more complete. For food aid, only developing countries were listed.
Transparency International	Corruption perception index	Corruption data was not available for many countries and corruption is incorporated in the freedom indices



## CHAPTER 6. EMPIRICAL RESULTS AND DISCUSSION

This chapter presents the empirical results of the impact of selected economic variables on the indicator of food security as measured by per capita dietary energy supply and discusses the implications of these results. Initially, a model with per capita dietary energy supply as the dependent variable, and income (GDP) per capita and the political variables as part of the explanatory variables on the right hand side, was estimated. However, income per capita was highly correlated with the political variables. Thus, the estimation is performed in two steps: first, a model describing the relationship between per capita income and political institutions was estimated and then, the regression of a model for the relationship between per capita income and per capita dietary energy supply was estimated. Viewed in a simultaneous equation context, this provides a link between per capita dietary energy supply and the political variables indirectly through per capita income.

The chapter is divided into two sections: the first section provides the empirical results of the relationship between per capita income and the political institution variables, and the second section links per capita income to per capita dietary energy supply. The first section also provides a brief description of previous empirical studies investigating the relationship between income, economic growth and political institutions. Based on the results of these empirical studies, cross-country regressions were used to show the link between economic growth and a basic set of macroeconomic and political variables. In the second section, regression models using different explanatory variables and per capita dietary energy supply as the dependent variable were estimated using Ordinary Least Squares (OLS) for the cross-

sectional units. Finally, two stage least squares (2SLS) is also used to address the endogeneity of income per capita.

### **Economic Growth and Political Institutions**

#### **Previous empirical studies on economic growth**

This section briefly describes the models and variables used in previous empirical studies designed to determine the relationship between economic growth and political institutions. Chapter 4 has discussed the findings of these studies. Using these past studies, the next section shows the basic model used to determine the link between income or economic growth and political variables.

Scully (1988) used a simple neoclassical growth function of the form  $g_y = e_k \cdot g_k$  where  $g_y$  is the growth rate of the growth rate of output per head,  $e_k$  is the elasticity of output per head with respect to the capital-labor ratio and  $g_k$  is the growth rate of the capital-labor ratio. The compound growth rate of real gross domestic product per capita for the period 1960 to 1980 is the dependent variable and the compound growth rate of the real capital-labor ratio for the same period is the explanatory variable in the model. Scully used population as the proxy for the labor force and he used the averages of Gastil's measures of political and civil liberty and economic freedom for the period 1973 to 1980 as the institutional variables.

In the study by McMillan, Rausser and Johnson (1993), per capita GDP, parity purchasing power corrected in 1980 U.S. dollars, is the dependent variable in an aggregated production function model. The independent variables include the difference in the logarithms of the capital-to-labor ratio between the current and previous years, the difference

in the logarithms of population between the current and previous years and the level of real GDP with terms of trade adjustment. They used Gastil's political rights and civil liberties to measure institutional structure of the national economy. The sample covered the period from 1972 to 1988.

Levine and Renelt (1992) and de Haan and Strum (2000) examined the robustness of the coefficients of macroeconomic and institutional explanatory variables linked to economic growth using a variant of extreme-bounds analysis. The general form of their equation takes the form:

$$Y_i = \alpha M_i + \beta F_i + \gamma Z_i + u_i$$

where  $Y_i$  is the average growth of per capita GDP of country  $i$ ;  $M_i$  is a set of standard economic explanatory variables based on previous empirical studies which include initial level of real GDP per capita, average investment share to GDP and secondary-school enrollment rate in the initial year;  $Z_i$  is a subset of additional economic explanatory variables which may be related to economic growth and these include average population growth, the average ratio of real government consumption to GDP, the average inflation rate and the average ratio of export and import to GDP; and  $u_i$  is an error term. Levine and Renelt (1992) found that the relationship between many of the variables considered in the literature and economic growth was not robust. Many coefficients changed signs and/or significance when small changes in the conditioning set of variables ( $Z_i$ ) were made.

Weede (1983) offered two alternative indicators of economic growth as the dependent variable: the average growth rates of GNP per capita and of GDP per capita for the period 1960-1979. The independent variables included a measure of political democracy in 1965,

the initial level of income per capita in 1965, the average of gross domestic investment as a percentage of GDP for the 1960, 1965, 1970 and 1973 values, primary and secondary school enrollment ratios in 1960 and the military participation ratio in 1960. Another study conducted by Fosu (1992) examined an equation of the form:

$$\dot{Q} = \alpha_0 + \alpha_1 \dot{L} + \alpha_2 \dot{K} + \alpha_3 \dot{X} + \alpha_4 P + v$$

where  $\dot{Q}$  is the mean annual GDP growth rate for the period 1960 to 1986,  $\dot{L}$  is the mean annual percent growth rate of the labor force,  $\dot{K}$  is the mean annual gross domestic investment as a percentage of GDP, and  $\dot{X}$  is the average annual growth rate of merchandise exports.  $P$  is a measure of political instability and  $v$  is the error term.

### **Empirical Results**

#### **Income and political institutions**

Based on the literature and the studies discussed above, and based on the available data, this study presents a number of models showing the relationship between the growth rate of per capita real GDP and macroeconomic and political variables. The dependent variable is the growth rate of per capita real GDP for the period between 1991 and 1995. The right-hand side variables are chosen from a pool of explanatory variables discussed in the various empirical studies. The models used in this specification are presented in this section.

In cross-sectional studies, the OLS estimates may be inefficient due to the presence of heteroskedasticity. Thus, White's heteroskedastic-consistent covariance matrix estimation was used to correct for heteroskedasticity (de Haan and Strum 2000; SHAZAM 1993). Table 6.1 shows the alternative models and the associated empirical results. The dependent

variable is the growth rate of per capita real GDP (*GDPGRT*) is estimated using the following two equations:

$$GDPGRT_{it} = \alpha_0 + LABFRC_{it}\alpha_1 + XGRT_{it}\alpha_2 + GINV_{it}\alpha_5 + PRCL_{it}\alpha_{11} + \varepsilon_{it} \quad (6.1a)$$

$$GDPGRT_{it} = \alpha_0 + GDPI_{it}\alpha_3 + GDPI_{it}^2\alpha_4 + GINV_{it}\alpha_5 + SEC_{it}\alpha_6 + PRIM_{it}\alpha_7 + AVGINF_{it}\alpha_8 + GCON_{it}\alpha_9 + TRADE_{it}\alpha_{10} + PRCL_{it}\alpha_{11} + e_{it} \quad (6.1b)$$

where  $i = 1, 2, \dots, N$  representing the number of countries and  $t = 1995$  the period under study.

*LABFRC*: the average growth rate of the labor force for the period 1991 to 1995;

*XGRT*: the average of the annual growth rate of the exports for the period 1991 to 1995;

*GDPI*: the initial (1991) real GDP per capita; and *GDPI*<sup>2</sup>: the square of *GDPI*;

*GINV*: the average gross domestic investment as a percentage of GDP for 1991-1995;

*SEC*: the secondary school enrollment ratio for 1991;

*PRIM*: the primary school enrollment ratio for 1991;

*AVGINF*: the average growth rate of inflation (GDP deflator) for 1991-1995;

*GCON*: the average government consumption as percentage of GDP for 1991-1995;

*TRADE*: the average trade (exports plus imports) as percentage of GDP for 1991-1995;

*PRCL*: the index for political rights and civil liberties for 1995 where *FREE* denotes the combined political rights and civil liberties ranging between 2 and 4, *PFREE* (partly free) between 5 and 9 and *NFREE* (not free) between 10 and 14.

Model (i) presents the regression results using *LABFRC*, *XGRT*, *GINV* and *PRCL* as the right hand-side variables and the growth rate of per capita real GDP as the dependent variable. *GINV* is used as a measure of the growth of capital. The model shows that the coefficients for *XGRT* and *GINV* are positive and highly significant (at 0.01 level of

Table 6.1. OLS regression results for the growth rate of per capita real GDP with political rights and civil liberties included with other explanatory variables

Right hand-side variable	Estimated Coefficient	Model (i)	Model (ii)	Model (iii)	Model (iv)	Model (v)	Model (vi)
<i>LABFRC</i>	$a_1$	0.11 (0.40)	-----	-----	-----	-----	-----
<i>XGRT</i>	$a_2$	0.20 (3.91) <sup>a</sup>	-----	-----	-----	-----	-----
<i>GDPI</i>	$a_3$	-----	0.00021 (2.38) <sup>b</sup>	0.00065 (2.03) <sup>b</sup>	0.00014 (1.68) <sup>c</sup>	0.00017 (2.09) <sup>b</sup>	0.00016 (2.00) <sup>b</sup>
<i>GDPI<sup>2</sup></i>	$a_4$	-----	-----	-0.2E-07 (-1.75) <sup>c</sup>	-----	-----	-----
<i>GINV</i>	$a_5$	0.12 (3.24) <sup>a</sup>	0.13 (2.47) <sup>b</sup>	0.12 (2.53) <sup>b</sup>	0.15 (2.37) <sup>b</sup>	0.10 (2.36) <sup>b</sup>	0.11 (2.88) <sup>a</sup>
<i>SEC</i>	$a_6$	-----	-0.08 (-3.24) <sup>a</sup>	-0.09 (-3.21) <sup>a</sup>	-0.09 (-3.52) <sup>a</sup>	-0.07 (-3.08) <sup>a</sup>	-0.07 (-2.99) <sup>a</sup>
<i>PRIM</i>	$a_7$	-----	0.04 (2.00) <sup>b</sup>	0.04 (1.78) <sup>c</sup>	0.04 (1.75) <sup>c</sup>	0.04 (1.89) <sup>c</sup>	0.04 (2.18) <sup>b</sup>
<i>AVGINF</i>	$a_8$	-----	-----	-----	-----	-0.002 (-2.15) <sup>b</sup>	-0.002 (-2.26) <sup>b</sup>
<i>GCON</i>	$a_9$	-----	-----	-----	-----	-----	-0.14 (-3.00) <sup>a</sup>
<i>TRADE</i>	$a_{10}$	-----	-----	-----	0.03 (3.31) <sup>a</sup>	-----	-----
<i>PRCL: FREE</i>	$a_{11}$	1.56 (1.76) <sup>c</sup>	3.84 (2.97) <sup>a</sup>	3.60 (2.94) <sup>a</sup>	4.63 (3.33) <sup>a</sup>	3.20 (2.64) <sup>b</sup>	4.37 (3.51) <sup>a</sup>
<i>PFREE</i>	$a_{11'}$	-0.31 (-0.41)	0.83 (0.76)	0.92 (0.83)	1.06 (0.95)	0.50 (0.48)	0.63 (0.64)
<i>CONSTANT</i>	$a_0$	-3.21 (-2.92) <sup>a</sup>	-4.30 (-2.59) <sup>b</sup>	-4.16 (-2.48) <sup>b</sup>	-5.42 (-3.11) <sup>a</sup>	-3.07 (-1.95)	-1.91 (-1.14)
	$R^2$	0.41	0.24	0.26	0.31	0.34	0.40
	$\bar{R}^2$	0.38	0.21	0.22	0.28	0.30	0.37
	$N^d$	112	140	140	131	140	135

t-statistics are in parenthesis

<sup>a</sup> statistically significant at the 0.01 level

<sup>b</sup> statistically significant at the 0.05 level

<sup>c</sup> statistically significant at the 0.1 level

<sup>d</sup> sample sizes differ between models because of missing data for some countries for different variables

significance) which implies that higher growth rates in capital and exports are positively associated with the growth rate in per capita real GDP. The coefficient for *LABFRC* is positive but not statistically significant<sup>11</sup>.

In terms of the political variables, the coefficient for *FREE* is positive and significant at the 0.1 probability level while the coefficient for *PFREE* is negative but close to zero and not statistically significant. The positive value of the variable *FREE* indicates that the conditional value of the growth rate of per capita real GDP is higher compared to *NFREE* (the left-out dummy variable to avoid the dummy variable trap). Since the coefficient for *PFREE* is almost zero, this implies that the conditional expected value of the real per capita GDP growth rate is essentially the same for countries that are categorized as partly free and not free.

The rest of the models (ii to vi) include independent variables used in the other studies that have examined the relationship between economic growth and political variables (equation 6.1b). Model (ii) is the basic model used by Levine and Renelt (1992), and includes the initial value of real GDP per capita in 1991 (*GDPI*), the investment variable (*GINV*), the initial values of both primary and secondary school enrollments for 1991 (*PRIM* and *SEC*) along with the political variables. The coefficients for *GDPI* and *GINV* are both positive and statistically significant. The *PRIM* coefficient is also positive and significant at the 0.05 significance level while the coefficient for secondary school enrollment (*SEC*) is negative and highly significant. Weede (1983) also estimated a positive coefficient for primary school enrollment and a positive but not a statistically significant coefficient for

---

<sup>11</sup> When the mean annual GDP growth rate is used (as in Fosu 1992) instead of the growth rate of per capita GDP, the *LABFRC* coefficient is positive and significant at 0.01 level of significance. The rest of the variables retain their sign and level of significance.

secondary school enrollment. When he considered only low and middle income nations, the coefficient for secondary school enrollment was negative but not significant.

Model (iii) considers a curvilinear relationship between the level of income and economic growth and shows that the coefficient for *GDPI* is still positive and significant while the coefficient for *GDPI*<sup>2</sup> is negative and significant at 0.05 significance level. The sign and significance of the coefficients for the rest of the variables are similar to model (ii) except for the *PRIM* coefficient which is positive and significant at the 0.1 level.

Harrison (1996) reviews the significance of openness to trade for economic growth particularly in terms of the new growth theories, which suggest that trade policy has a positive impact on technological change and therefore on long-run growth. Openness to trade provides access to imported inputs (and therefore new technology) which expands the market for producers and increases the returns to innovation. Thus, *TRADE*, which measures the openness to trade, is added in model (iv). The coefficient for *TRADE* is positive and highly significant.

When average inflation (*AVGINF*) and government consumption (*GCON*) are introduced into the model, the coefficients for *GDPI*, *GINV* and *PRIM* are positive and statistically significant. The *SEC* coefficient remains negative and significant and the coefficients for *AVGINF* and *GCON* are also negative and statistically significant. This implies that inflation and government consumption are negatively correlated with economic growth measured in terms of the growth rate of per capita real GDP.

The sign and significance of the estimated coefficients of the political variables are similar for models (ii) to (vi) with the coefficient for *FREE* positive and highly significant while the coefficient for *PFREE* positive but not statistically significant. For all the models,



when the coefficient for *NFREE* is estimated instead of *PFREE*, the coefficient is negative and not significant. This indicates that there are basically two broad political distinctions for countries: those that are categorized as *FREE* and all other nations<sup>12</sup>.

Levine and Renelt (1992) discussed the statistical and conceptual problems with some of the right-hand side variables. These included the measurement problems with the initial level of per capita GDP and the initial secondary-school enrollment rate, which may result in biased estimates<sup>13</sup>. They also discussed the poor census data for population and the ambiguous causal link between the dependent variable (the growth rate in per capita GDP) and the average annual population growth. Levine and Renelt estimated the coefficient of the average annual population growth and found it to be positive but not significant. For this reason, population growth was not included in the models provided in Table 6.1.

Table 6.2 uses the level of per capita GDP in 1995 as the dependent variable instead of the growth rate in per capita GDP. In this case the independent variables are lagged one period such that the initial level of per capita GDP and the observations for *GINV*, *TRADE*, and *GCON* are for 1994. However, the education variables (*SEC* and *PRIM*) remain for the year 1991 and the political variables (*FREE* and *PFREE*) are for the 1995 period. The inflation rate for 1994 (*INF*) is used in place of *AVGINF*, the average growth rate of inflation for 1991 to 1995, which appears in Table 6.1.

---

<sup>12</sup> This primary distinction is made by Murdoch and Sandler, 1997.

<sup>13</sup> Mismeasurement of initial income may lead to the coefficient on initial income being biased toward being negative. When instrumental variables are used to control for measurement error, initial income and literacy rate may become insignificant (Levine and Renelt, 1992).

Table 6.2. OLS regression results for the level of per capita real GDP with political rights and civil liberties included as explanatory variables

Right hand-side variable	Estimated Coefficient	Model (i)	Model (ii)	Model (iii)	Model (iv)	Model (v)
<i>LABFRCI</i>	$b_1$	1.62 (0.58)	-----	-----	-----	-----
<i>XPRT</i>	$b_2$	2.22 (1.78) <sup>c</sup>	-----	-----	-----	-----
<i>GDPI</i>	$b_3$	1.02 (211.6) <sup>a</sup>	1.02 (148.8) <sup>a</sup>	1.01 (205.6) <sup>a</sup>	1.01 (205.6) <sup>a</sup>	1.02 (165.0) <sup>a</sup>
<i>GDPI</i> <sup>2</sup>	$b_4$	-----	-----	-----	-----	-----
<i>GINV</i>	$b_5$	2.80 (1.81) <sup>c</sup>	2.11 (1.27)	2.87 (1.38)	2.88 (1.38)	-----
<i>SEC</i>	$b_6$	-0.56 (-0.83)	-0.25 (-0.37)	0.12 (0.18)	0.12 (0.18)	-----
<i>PRIM</i>	$b_7$	-----	0.51 (0.76)	-----	-----	-----
<i>INF</i>	$b_8$	-----	-----	-----	0.00046 (0.26)	-----
<i>GCON</i>	$b_9$	-5.69 (-2.25) <sup>b</sup>	-5.76 (-2.47) <sup>b</sup>	-6.59 (-2.29) <sup>b</sup>	-6.59 (-2.28) <sup>b</sup>	-----
<i>TRADE</i>	$b_{10}$	-----	-----	2.31 (2.12) <sup>b</sup>	2.31 (2.12) <sup>b</sup>	-----
<i>PRCL: FREE</i>	$b_{11}$	218.48 (3.14) <sup>a</sup>	176.44 (2.29) <sup>b</sup>	228.13 (3.46) <sup>a</sup>	228.42 (3.46) <sup>a</sup>	163.23 (2.65) <sup>a</sup>
<i>PFREE</i>	$b_{11'}$	26.37 (0.72)	33.87 (0.85)	24.03 (0.64)	24.29 (0.64)	14.80 (0.34)
<i>CONSTANT</i>	$b_0$	-132.11 (-0.95)	-42.87 (-0.99)	-33.43 (-0.73)	-34.17 (-0.72)	-31.57 (-1.21)
	$R^2$	0.99	0.99	0.99	0.99	0.99
	$\bar{R}^2$	0.99	0.99	0.99	0.99	0.99
	$N^d$	129	135	131	131	153

t-statistics are in parenthesis

<sup>a</sup> statistically significant at the 0.01 level

<sup>b</sup> statistically significant at the 0.05 level

<sup>c</sup> statistically significant at the 0.1 level

<sup>d</sup> sample sizes differ between models because of missing data for some countries for different variables

As expected, the coefficient for *GDPI* is positive and highly significant. Since the dependent variable is the level of per capita real GDP in 1995 and *GDPI* in Table 6.2 is the 1994 value of real GDP per capita, *GDPI* explains the majority of the variation in the dependent variable. This accounts for the extremely high  $R^2$  (almost perfect fit) in all the model specifications. The coefficient for *GDPI* is also equal to one, which indicates that the

models are not stable<sup>14</sup>. Nevertheless, the model is used as a gross approximation to show the relationship between the level of per capita real GDP and the political variables.

The *LABFRC* coefficient is positive but not statistically significant while that for exports is positive and significant at 0.1 significance level. The coefficient for *GINV* is also positive but significant only in model (i). The coefficients for the education variables (*SEC* and *PRIM*) are not statistically significant. The inflation coefficient (*INF*) is positive, not statistically significant and very close to zero. The variable measuring openness to trade (*TRADE*) has a positive and significant coefficient which implies openness to trade is positively associated with the level of per capita income.

The coefficient for *GCON* is negative and significant at the 0.05 significance level. This indicates that countries that allocate a larger proportion of their GDP to government consumption tend to suffer lower levels of per capita income. Although *GDPI* accounts for the majority of the explanatory power, the coefficients for the political variables are statistically significant. The variables measuring political freedoms show a positive and highly significant coefficient for *FREE* and a positive but not significant coefficient for *PFREE*.

### **Per capita dietary energy supply and income**

The previous section established the relationship between the growth rate of per capita real GDP (and the level of per capita real GDP) and political institutions. In this section, income, measured in terms of per capita GDP, is linked to per capita dietary energy supply, which is the indicator of food security. The regression equation 6.2 is a reduced form model.

---

<sup>14</sup> When the level of per capita GDP in 1980 is used as the initial level of income in model (ii), the coefficient for *GDPI* is less than one (0.67) and the coefficient for *FREE* is positive and significant while that for *PFREE* is positive but not significant.  $R^2$  is equal to 0.85.

It uses explanatory variables based on the discussion presented in Chapter 3 with respect to the underlying causes of food insecurity. The basic regression equation, with per capita dietary energy supply as the dependent variable, to be estimated is given as follows:

$$\begin{aligned}
 DES_{it} = & \beta_0 + AGLAB_{it}\beta_1 + UPOP_{it}\beta_2 + IRRIG_{it}\beta_3 + FERTC_{it}\beta_4 \\
 & + FRATE_{it}\beta_5 + MILEXP_{it}\beta_6 + ODA_{it}\beta_7 + CEREAL_{it}\beta_8 \\
 & + GDP_{it}\beta_9 + FEMP_{it}\beta_{10} + TRADE_{it}\beta_{11} + u_{it}
 \end{aligned} \tag{6.2}$$

where  $i = 1, 2, \dots, N$  (the number of countries) and  $t = 1995$ .

*DES*: per capita dietary energy supply;

*AGLAB*: labor force in agriculture as percentage of the total labor force;

*UPOP*: urban population as percentage of total population;

*IRRIG*: irrigated land as percentage of arable land;

*FERTC*: fertilizer consumption in 100 grams per hectare of arable land;

*FRATE*: total fertility rate in number of births per woman;

*MILEXP*: military expenditure as percentage of GNP;

*ODA*: official development assistance and official aid converted to per capita by dividing by total population;

*CEREAL*: cereal production in metric tons divided by total population;

*GDP*: per capita gross domestic product (GDP) in purchasing power parity;

*FEMP*: the female enrollment ratios in primary school as percentage of men;

*TRADE*: average trade (percent of GDP) used as the measure of openness.

Some explanatory variables are replaced by other variables in the regression equation with the parameters to be estimated given by  $\alpha_k$  for equation (6.1). These include:

*LIT*: the total adult literacy rates for people 15 years of age and older, which is substituted for *FEMP*;

*POPG*: the annual population growth (in percentage) which is substituted for *FRATE*;

*HECF*: the Heritage index of economic freedom where *EFREE* denotes the economic freedom index of 1.99 or less, *EMFREE* (mostly free) is the index between 2 and 2.99, *EMNFREE* (mostly not free) the index between 3 and 3.99, and *ENFREE* (not free) has a value of 4 and higher. *HECF* is used instead of *PRCL* in some model specifications.

A detailed description of the variables was presented Table 5.2 in Chapter 5 and again in Table D.2 in Appendix D. First, the model is estimated using ordinary least squares (OLS). The estimated equation incorporates most of the explanatory variables that have been used in previous studies as affecting food insecurity. In addition, the equation includes political variables, which are the primary interest of this study. OLS regressions on the cross-sectional data are performed using one year (1995). In this case the regression equation 6.2 will not include the subscript  $t$  which denotes the years.

#### **Ordinary Least Squares regression results**

Table 6.3a gives the results of various OLS regressions and the explanatory variables that were used with per capita dietary energy supply as the dependent variable. For all model specifications, the coefficient for per capita GDP (*GDP*) is positive and highly significant. This confirms the hypothesis that countries with high per capita incomes tend to enjoy higher levels of per capita dietary energy supply and therefore, tend to be more food secure. Low-income developing countries usually suffer from persistent food deficits and therefore, from chronic food insecurity.

Table 6.3a. OLS regression results with per capita dietary energy supply as the dependent variable and the level of real per capita GDP included as an independent variable

Right hand-side variable	Estimated Coefficient	Model (i)	Model (ii)	Model (iii)	Model (iv) <sup>1</sup>	Model (v)	Model (vi) <sup>2</sup>
<i>AGLAB</i>	$\beta_1$	-8.21 (-3.79) <sup>a</sup>	-8.13 (-3.73) <sup>a</sup>	-8.17 (-3.96) <sup>a</sup>	-10.16 (-4.84) <sup>a</sup>	-7.50 (-2.67) <sup>a</sup>	-6.13 (-2.75) <sup>a</sup>
<i>UPOP</i>	$\beta_2$	-----	-----	-----	-----	0.92 (0.40)	-----
<i>IRRIG</i>	$\beta_3$	-1.45 (-1.03)	-1.33 (-0.96)	-----	-0.86 (-0.60)	-1.39 (-0.98)	-0.29 (-0.21)
<i>FERTC</i>	$\beta_4$	0.06 (2.49) <sup>b</sup>	0.06 (2.62) <sup>a</sup>	0.06 (2.89) <sup>a</sup>	0.07 (2.80) <sup>a</sup>	0.06 (2.49) <sup>b</sup>	0.05 (2.03) <sup>b</sup>
<i>FRATE</i>	$\beta_5$	-108.60 (-3.38) <sup>a</sup>	-108.04 (-3.42) <sup>a</sup>	-89.70 (-3.03) <sup>a</sup>	-73.11 <sup>1</sup> (-2.15) <sup>b</sup>	-110.45 (-3.39) <sup>a</sup>	-144.31 (-3.86) <sup>a</sup>
<i>MILEXP</i>	$\beta_6$	10.43 (0.84)	4.45 (0.34)	2.00 (0.18)	2.00 (0.16)	9.93 (0.80)	8.89 (0.72)
<i>ODA</i>	$\beta_7$	1.09 (1.96) <sup>b</sup>	1.26 (2.27) <sup>b</sup>	1.04 (2.07) <sup>b</sup>	1.24 (2.10) <sup>b</sup>	1.09 (1.96) <sup>b</sup>	0.88 (1.54)
<i>CEREAL</i>	$\beta_8$	187.50 (1.83) <sup>c</sup>	176.70 (1.75) <sup>c</sup>	216.23 (2.32) <sup>b</sup>	241.91 (2.34) <sup>b</sup>	187.11 (1.82) <sup>c</sup>	280.55 (2.67) <sup>b</sup>
<i>GDP</i>	$\beta_9$	0.03 (2.98) <sup>a</sup>	0.03 (3.05) <sup>a</sup>	0.03 (3.42) <sup>a</sup>	0.03 (2.86) <sup>a</sup>	0.03 (2.91) <sup>a</sup>	0.03 (3.07) <sup>a</sup>
<i>FEMP</i>	$\beta_{10}$	65.53 (3.36) <sup>a</sup>	57.21 (2.94) <sup>a</sup>	54.16 (3.10) <sup>a</sup>	61.59 (3.07) <sup>a</sup>	65.22 (3.32) <sup>a</sup>	13.22 (1.41)
<i>FEMP<sup>2</sup></i>	$\beta_{10}$	-0.49 (-3.73) <sup>a</sup>	-0.43 (-3.31) <sup>a</sup>	-0.40 (-3.53) <sup>a</sup>	-0.44 (-3.31) <sup>a</sup>	-0.48 (-3.70) <sup>a</sup>	-0.15 <sup>2</sup> (2.18) <sup>b</sup>
<i>TRADE</i>	$\beta_{11}$	-----	-0.70 (-1.01)	-----	-----	-----	-----
<i>CONSTANT</i>	$\beta_0$	1250.6 (1.78) <sup>c</sup>	1582.5 (2.24) <sup>b</sup>	1523.6 (2.34) <sup>a</sup>	1036.8 (1.43)	1194.5 (1.66) <sup>c</sup>	3061.5 (8.02) <sup>a</sup>
	$R^2$	0.74	0.75	0.74	0.72	0.74	0.72
	$\bar{R}^2$	0.71	0.72	0.72	0.69	0.71	0.69
	$N^d$	114	113	125	114	114	114

t-statistics are in parenthesis

<sup>a</sup> statistically significant at the 0.01 level

<sup>b</sup> statistically significant at the 0.05 level

<sup>c</sup> statistically significant at the 0.1 level

<sup>d</sup> sample sizes differ between models because of missing data for some countries for different variables

<sup>1</sup> *POPG* used instead of *FRATE*

<sup>2</sup> Model (vi) uses the variable *LIT* instead of *FEMP*

The variable *AGLAB* is negative and is also highly significant. The negative sign of the estimated coefficient of *AGLAB* implies that a country with higher percentages of agricultural labor may suffer from lower levels of per capita dietary energy supplies. The coefficient for *UPOP*, urban population, is positive but not significant (model (v)). The correlation between

*AGLAB* and *UPOP* is  $-0.84$ , therefore the two variables are highly correlated. Thus, the variable *UPOP* was not included in the rest of the model specifications. The variables of *IRRIG* and *FERTC* are used to measure investments in agriculture. The *IRRIG* coefficient is negative and not statistically significant. However, the *FERTC* coefficient is positive and significant in all model specifications. Increased consumption of fertilizer is positively associated with per capita dietary energy supply.

In all the models except model (iv) *FRATE*, the fertility rate, is used as an explanatory variable. In model (iv), *FRATE* is replaced by *POPG*, the annual population growth, for comparison. The variable birth rate (*BIRTH*) was also used but did not show significant differences in results from *FRATE*. The coefficients of *FRATE* and *POPG* (model (iv)) are negative and significant which implies that high fertility rates and high population growth rates are associated with lower levels of per capita dietary energy supply. Higher cereal production is positively and significantly associated with per capita dietary energy supply.

The variable measuring female literacy, *FEMP*, is squared since a plot of *FEMP* against per capita dietary energy supply revealed a nonlinear relationship. The coefficient of *FEMP* is positive and highly significant while that for *FEMP*<sup>2</sup> is negative and significant. This implies that female education is positively associated with per capita dietary energy supply but at a decreasing rate. When total adult literacy rates are used instead of *FEMP* (model (vi)), the coefficient is positive but not statistically significant. This is a puzzling result since higher levels of literacy are usually associated with higher levels of income and therefore, higher consumption of food.

The coefficient for military expenditure is positive in some models and negative in others although it is not statistically significant in all cases. The coefficient of *ODA*, which

measures official aid, is positive and significant. Although the impact of development assistance (and food aid) on recipient countries has been strongly debated, this positive relationship indicates that assistance to developing countries may improve their food security situation. The *TRADE* coefficient in model (ii) is negative and not significant.

Table 6.3b. OLS regression results for per capita dietary energy supply as the dependent variable and the growth rate of real per capita GDP included as an independent variable

Right hand-side variable	Estimated Coefficient	Model (i)	Model (ii)	Model (iii)	Model (iv) <sup>1</sup>	Model (v)	Model (vi) <sup>2</sup>
<i>AGLAB</i>	$\alpha_1$	-10.82 (-5.51) <sup>a</sup>	-10.46 (-4.93) <sup>a</sup>	-10.72 (-5.66) <sup>a</sup>	-12.16 (-6.56) <sup>a</sup>	-9.65 (-3.57) <sup>a</sup>	-9.22 (-4.55) <sup>a</sup>
<i>UPOP</i>	$\alpha_2$	-----	-----	-----	-----	1.44 (0.63)	-----
<i>IRRIG</i>	$\alpha_3$	-1.30 (-0.91)	-0.98 (-0.64)	-----	-0.48 (-0.34)	-1.19 (-0.83)	-0.52 (-0.36)
<i>FERTC</i>	$\alpha_4$	0.07 (3.14) <sup>a</sup>	0.06 (2.35) <sup>b</sup>	0.07 (3.97) <sup>b</sup>	0.08 (3.37) <sup>a</sup>	0.07 (3.11) <sup>a</sup>	0.07 (2.81) <sup>a</sup>
<i>FRATE</i>	$\alpha_5$	-104.50 (-3.27) <sup>a</sup>	-106.44 (-3.20) <sup>a</sup>	-86.20 (-2.90) <sup>a</sup>	-92.13 <sup>1</sup> (-2.67) <sup>a</sup>	-107.54 (-3.31) <sup>a</sup>	-123.98 (-3.25) <sup>a</sup>
<i>MILEXP</i>	$\alpha_6$	13.99 (1.14)	14.46 (1.15)	3.01 (0.27)	7.38 (0.61)	13.15 (1.06)	11.54 (0.92)
<i>ODA</i>	$\alpha_7$	0.27 (0.50)	0.31 (0.57)	0.29 (0.61)	0.44 (0.79)	0.28 (0.53)	0.19 (0.35)
<i>CEREAL</i>	$\alpha_8$	236.34 (2.42) <sup>b</sup>	240.23 (2.41) <sup>b</sup>	280.88 (3.12) <sup>b</sup>	272.86 (2.79) <sup>a</sup>	233.80 (2.38) <sup>b</sup>	326.97 (3.15) <sup>a</sup>
<i>GDPGRT</i>	$\alpha_9$	15.20 (3.03) <sup>a</sup>	15.57 (3.04) <sup>a</sup>	11.51 (3.13) <sup>a</sup>	18.20 (3.45) <sup>a</sup>	15.12 (3.00) <sup>a</sup>	13.11 (2.41) <sup>b</sup>
<i>FEMP</i>	$\alpha_{10}$	62.79 (3.22) <sup>a</sup>	63.54 (3.17) <sup>a</sup>	54.54 (3.10) <sup>a</sup>	59.51 (3.01) <sup>a</sup>	62.34 (3.19) <sup>a</sup>	4.81 <sup>2</sup> (0.50)
<i>FEMP</i> <sup>2</sup>	$\alpha_{10}$	-0.46 (-3.56) <sup>a</sup>	-0.47 (-3.49) <sup>a</sup>	-0.41 (-3.52) <sup>a</sup>	-0.42 (-3.23) <sup>a</sup>	-0.46 (-3.52) <sup>a</sup>	-0.08 <sup>2</sup> (1.12)
<i>TRADE</i>	$\alpha_{11}$	-----	0.60 (0.37)	-----	-----	-----	-----
<i>CONSTANT</i>	$\alpha_0$	1508.1 (2.16) <sup>b</sup>	1443.4 (2.00) <sup>b</sup>	1704.7 (2.60) <sup>a</sup>	1291.8 (1.83) <sup>c</sup>	1415.9 (1.98) <sup>b</sup>	3428.0 (9.13) <sup>a</sup>
	R <sup>2</sup>	0.74	0.73	0.74	0.73	0.74	0.70
	$\bar{R}^2$	0.71	0.70	0.72	0.70	0.71	0.68
	N <sup>d</sup>	114	111	125	114	114	114

t-statistics are in parenthesis

<sup>a</sup> statistically significant at the 0.01 level

<sup>b</sup> statistically significant at the 0.05 level

<sup>c</sup> statistically significant at the 0.1 level

<sup>d</sup> sample sizes differ between models because of missing data for some countries for different variables

<sup>1</sup> *POPG* used instead of *FRATE*

<sup>2</sup> Model (vi) uses the variable *LIT* instead of *FEMP*



In Table 6.3b, the growth rate of real GDP per capita (*GDPGRT*) is used instead of the level of per capita GDP as an explanatory variable. In this case, the coefficient for *GDPGRT* is also positive and significant which implies that positive economic growth is associated with higher levels of caloric intake. The coefficient of *AGLAB* remains negative and highly significant. The results are also similar to those of Table 6.3a in terms of the sign and significance for the *UPOP*, *IRRIG*, *FERTC*, *FRATE*, *CEREAL* and *FEMP* coefficients. The coefficient for *MILEXP* is positive but not significant. Although the coefficient for *ODA* is negative for some specifications of the model and positive in others, it is not significant. The *TRADE* coefficient is positive but also not statistically significant.

Table 6.4 presents the initial model specification where both per capita GDP and the political variables were included in the OLS regression. The results show that the *GDP* coefficient remains positive and significant. However, the coefficients for *FREE* and *PFREE* are negative and not statistically significant for most model specifications. When *GDP* is removed from the model (acknowledging the specification or omitted variable bias), the political variable coefficients have the expected sign (i.e., become positive) and the coefficient for *FREE* becomes statistically significant. This is an indication that per capita income (*GDP*) and the freedom variables are highly correlated.

The results for the rest of the variables are similar to those presented in Table 6.3a. The coefficients for *AGLAB* and *FRATE* are negative and significant while the coefficients for *CEREAL* and *FERTC* are positive and significant for all model specifications. The coefficients for *IRRIG*, *MILEXP* and *TRADE* are negative and not statistically significant. Official development assistance (*ODA*) continues to be positive and significant.

Table 6.4. OLS regression results for per capita dietary energy supply as the dependent variable and both real per capita GDP and the political variables as independent variables

Right hand-side variable	Estimated Coefficient	Model (i)	Model (ii)	Model (iii) <sup>1</sup>	Model (iv)	Model (v)	Model (vi) <sup>2</sup>
<i>AGLAB</i>	$\gamma_1$	-8.32 (-3.85) <sup>a</sup>	-8.29 (-4.01) <sup>a</sup>	-10.32 (-4.91) <sup>a</sup>	-7.68 (-2.73) <sup>a</sup>	-8.36 (-3.85) <sup>a</sup>	-6.72 (-3.04) <sup>a</sup>
<i>UPOP</i>	$\gamma_2$	-----	-----	-----	0.83 (0.36)	-----	-----
<i>IRRIG</i>	$\gamma_3$	-1.85 (-1.31)	-----	-1.22 (-0.84)	-1.80 (-1.26)	-1.74 (-1.25)	-0.95 (-0.67)
<i>FERTC</i>	$\gamma_4$	0.06 (2.53) <sup>b</sup>	0.06 (2.86) <sup>a</sup>	0.07 (2.85) <sup>a</sup>	0.06 (2.52) <sup>b</sup>	0.07 (2.71) <sup>a</sup>	0.05 (2.12) <sup>b</sup>
<i>FRATE</i>	$\gamma_5$	-112.90 (-3.44) <sup>a</sup>	-89.07 (-2.96) <sup>a</sup>	-76.35 <sup>1</sup> (-2.13) <sup>b</sup>	-114.30 (-3.45) <sup>a</sup>	-110.96 (-3.44) <sup>a</sup>	-148.08 (-4.00) <sup>a</sup>
<i>MILEXP</i>	$\gamma_6$	4.28 (0.33)	-3.41 (-0.28)	-4.01 (-0.31)	3.89 (0.30)	-1.33 (-0.10)	2.45 (0.19)
<i>ODA</i>	$\gamma_7$	1.25 (2.07) <sup>b</sup>	1.08 (2.00) <sup>b</sup>	1.40 (2.13) <sup>b</sup>	1.24 (2.04) <sup>b</sup>	1.41 (2.36) <sup>b</sup>	0.97 (1.56)
<i>CEREAL</i>	$\gamma_8$	188.94 (1.85) <sup>c</sup>	216.76 (2.32) <sup>b</sup>	244.90 (2.37) <sup>b</sup>	188.55 (1.84) <sup>c</sup>	178.42 (1.78) <sup>c</sup>	269.08 (2.60) <sup>a</sup>
<i>GDP</i>	$\gamma_9$	0.03 (2.67) <sup>a</sup>	0.03 (2.84) <sup>a</sup>	0.03 (2.51) <sup>b</sup>	0.03 (2.57) <sup>a</sup>	0.03 (2.64) <sup>a</sup>	0.03 (2.53) <sup>b</sup>
<i>FEMP</i>	$\gamma_{10}$	59.17 (2.90) <sup>a</sup>	49.97 (2.72) <sup>a</sup>	55.76 (2.65) <sup>a</sup>	58.84 (2.87) <sup>a</sup>	51.27 (2.53)	10.36 <sup>2</sup> (1.07)
<i>FEMP</i> <sup>2</sup>	$\gamma_{10}$	-0.44 (-3.28) <sup>a</sup>	-0.38 (-3.13) <sup>a</sup>	-0.40 (-2.89) <sup>a</sup>	-0.44 (-3.25) <sup>a</sup>	-0.39 (-2.90) <sup>a</sup>	-0.13 (-1.86) <sup>c</sup>
<i>TRADE</i>	$\gamma_{11}$	-----	-----	-----	-----	-0.84 (-1.21)	-----
<i>PRCL: FREE</i>	$\gamma_{12}$	-112.90 (-1.05)	-50.79 (-0.53)	-106.07 (-0.94)	-108.63 (-1.00)	-102.47 (-0.97)	-93.56 (-0.84)
<i>PFREE</i>	$\gamma_{12}$	-106.23 (1.50)	-83.85 (-1.25)	-97.33 (-1.33)	-106.95 (-1.50)	-102.18 (-1.46)	-148.84 (-2.12) <sup>b</sup>
<i>CONSTANT</i>	$\gamma_0$	1585.2 (2.11) <sup>b</sup>	1738.5 (2.48) <sup>b</sup>	1332.2 (1.72) <sup>c</sup>	1535.0 (2.00) <sup>b</sup>	1907.8 (2.53) <sup>b</sup>	3321.9 (8.25) <sup>a</sup>
	$R^2$	0.75	0.75	0.73	0.75	0.76	0.73
	$\bar{R}^2$	0.72	0.72	0.70	0.71	0.72	0.70
	$N^d$	113	124	113	113	112	113

t-statistics are in parenthesis

<sup>a</sup> statistically significant at the 0.01 level<sup>b</sup> statistically significant at the 0.05 level<sup>c</sup> statistically significant at the 0.1 level<sup>d</sup> sample sizes differ between models because of missing data for some countries for different variables<sup>1</sup> *POPG* used instead of *FRATE*<sup>2</sup> Model (vi) uses the variable *LIT* instead of *FEMP*

Additional variables were used in the model specifications represented in Tables 6.1 to 6.4. These included the total external debt per capita (*EDEBT*), the Gini coefficient, which measures income inequality, and the Heritage economic freedom variables. The coefficients for both *EDEBT* and *GINI* were negative and not statistically significant. The OLS regression results for *DES* using the Heritage economic freedom variables *EFREE*, *EMFREE* and *EMNFREE* (with *ENFREE* as the omitted variable) in place of the political freedom variable (*PRCL*) found that the coefficients had the expected sign (positive for *EFREE* and *EMFREE* and negative for *EMNFREE*). However, the coefficients were not significant.

Table E.1 in Appendix E shows the regression results for per capita dietary energy supply when only countries consuming less than 2500 kilocalories per person per day are included. The results remain the same for the coefficients of *AGLAB*, *CEREAL* and *GDP*. Most of the variables, however, lose their significance. The only exception is *MILEXP*. In this case, the coefficient for *MILEXP* is negative and statistically significant. This points to the high military expenditure of many developing countries, probably at the expense of programs that could alleviate food deficiencies.

Several model specifications using country partitions were also performed to examine the results based on certain characteristics in an attempt to explain the sign (and/or significance level) of the variables *IRRIG* and *AGLAB*. Therefore, countries were partitioned into those which consistently used high irrigation for the past 20 years and those where irrigation usage was low. Partitions were also made for countries with a high agricultural labor force and those with low percentages of the labor force in agriculture. These specifications did not yield any significant results and did not change the sign and significance of the irrigation and agricultural labor variables.

It is important to point out that regression results do not prove causality even if they are statistically significant. Regression analysis merely tests whether there is a significant quantitative relationship and the strength and direction of that relationship. Cause-and effect relationships are often very subtle. In order to determine causality, economic theory and common sense must be considered in the analysis (Studenmund 1997).

### **Two-stage Least Squares regression results**

One of the classical assumptions in linear regression models is that the explanatory variables are non-stochastic or fixed in repeated samples and therefore, not correlated with the disturbances. If this assumption is violated, OLS is biased and inconsistent (Baltagi 1998). Endogeneity may exist because some explanatory variables are determined simultaneously with the dependent variable. To control for endogeneity, two-stage least squares regression is performed. In the model represented by equation 6.2, *GDP* is considered to be endogenous. Although, having low levels of income are likely to lead to low dietary energy supply, low dietary energy supply may result in low income (*GDP*).

Table 6.5 shows the two-stage least squares result using per capita dietary energy supply as the dependent variable and using the same explanatory variables as Table 6.3a. with predicted values of *GDP* from model (v) in Table 6.2. Two-stage least squares is also estimated using the SHAZAM statistical program which provides estimates for the right hand-side endogenous variable, *GDP*, with *AGLAB*, *IRRIG*, *FERT*, *MILEXP*, *ODA*, *FRATE*, *CEREAL* and *FEMP* as the exogenous variables and per capita dietary energy supply as the left hand-side endogenous variable (Table E.2 in Appendix E).

Table 6.5. 2SLS regression results for per capita dietary energy supply as the dependent variable

Right hand-side variable	Estimated Coefficient	Model (i)	Model (ii)	Model (iii)	Model (iv) <sup>1</sup>	Model (v)	Model (vi) <sup>2</sup>
<i>AGLAB</i>	$\delta_1$	-8.33 (-3.78) <sup>a</sup>	-8.34 (-3.99) <sup>a</sup>	-7.65 (-2.70) <sup>a</sup>	-10.40 (-4.87) <sup>a</sup>	-8.31 (-3.74) <sup>a</sup>	-6.18 (-2.73) <sup>a</sup>
<i>UPOP</i>	$\delta_2$	-----	-----	0.91 (0.39)	-----	-----	-----
<i>IRRIG</i>	$\delta_3$	-1.59 (-1.13)	-----	-1.54 (-1.08)	-1.04 (-0.71)	-1.48 (-1.07)	-0.39 (-0.28)
<i>FERTC</i>	$\delta_4$	0.06 (2.60) <sup>a</sup>	0.06 (3.00) <sup>a</sup>	0.06 (2.59) <sup>a</sup>	0.07 (2.91) <sup>a</sup>	0.07 (2.75) <sup>a</sup>	0.05 (2.11) <sup>b</sup>
<i>FRATE</i>	$\delta_5$	-106.78 (-3.30) <sup>a</sup>	-86.93 (-2.90) <sup>a</sup>	-108.44 (-3.30) <sup>a</sup>	-67.79 <sup>1</sup> (-1.96) <sup>c</sup>	-105.75 (-3.32) <sup>a</sup>	-145.32 (-3.87) <sup>a</sup>
<i>MILEXP</i>	$\delta_6$	9.45 (0.76)	0.81 (0.07)	8.88 (0.70)	0.88 (0.07)	3.26 (0.26)	7.57 (0.60)
<i>ODA</i>	$\delta_7$	1.05 (1.86) <sup>c</sup>	0.99 (1.95) <sup>c</sup>	1.05 (1.84) <sup>c</sup>	1.17 (1.94) <sup>c</sup>	1.22 (2.19) <sup>b</sup>	0.84 (1.44)
<i>CEREAL</i>	$\delta_8$	186.65 (1.81) <sup>c</sup>	217.45 (2.33) <sup>b</sup>	186.95 (1.81) <sup>c</sup>	243.60 (2.34) <sup>b</sup>	176.07 (1.74) <sup>c</sup>	281.12 (2.66) <sup>a</sup>
<i>GDP</i>	$\delta_9$	0.03 (2.77) <sup>a</sup>	0.03 (3.19) <sup>a</sup>	0.03 (2.68) <sup>a</sup>	0.03 (2.59) <sup>a</sup>	0.03 (2.80) <sup>a</sup>	0.03 (2.90) <sup>a</sup>
<i>FEMP</i>	$\delta_{10}$	67.63 (3.44) <sup>a</sup>	55.97 (3.17) <sup>a</sup>	67.30 (3.40) <sup>a</sup>	63.56 (3.14) <sup>a</sup>	59.19 (3.02) <sup>a</sup>	14.25 <sup>2</sup> (1.52)
<i>FEMP</i>	$\delta_{10}$	-0.50 (-3.81) <sup>a</sup>	-0.42 (-3.60) <sup>a</sup>	-0.50 (-3.78) <sup>a</sup>	-0.45 (-3.39) <sup>a</sup>	-0.44 (-3.40) <sup>a</sup>	-0.16 (-2.30) <sup>a</sup>
<i>TRADE</i>	$\delta_{11}$	-----	-----	-----	-----	-0.78 (-1.11)	-----
<i>CONSTANT</i>	$\delta_0$	1188.3 (1.68) <sup>c</sup>	1465.3 (2.24) <sup>b</sup>	1135.2 (1.57)	987.75 (1.36)	1531.0 (2.16) <sup>b</sup>	3061.7 (8.00) <sup>a</sup>
$R^2$		0.74	0.74	0.74	0.72	0.75	0.72
$\bar{R}^2$		0.71	0.72	0.71	0.69	0.72	0.69
$N^c$		112	123	112	112	111	112

t-statistics are in parenthesis

<sup>a</sup> statistically significant at the 0.01 level

<sup>b</sup> statistically significant at the 0.05 level

<sup>c</sup> statistically significant at the 0.1 level

<sup>d</sup> sample sizes differ between models because of missing data for some countries for different variables

<sup>1</sup> *POPG* used instead of *FRATE*

<sup>2</sup> *LIT* used instead of *FEMP*

The two-stage least squares results show that the *GDP* coefficient is positive and highly significant. The coefficient for *AGLAB* is negative and significant in all model specifications. The coefficient for *IRRIG* is negative and not significant while the *FERTC* coefficient is positive and statistically significant. The coefficient for official development

assistance (*ODA*) is positive and significant. The sign of the coefficient for cereal production is positive and significant.

The coefficient for *FRATE* is negative and highly significant. When *POPG* is used instead of *FRATE*, the coefficient remains negative and significant but at 0.1 significance level. The coefficient for *MILEXP* is positive but it is not statistically significant. The *TRADE* coefficient is also not significant. The *FEMP* coefficient is positive and highly significant while the coefficient for *FEMP* is negative and also significant at 0.01 significance level. However, when literacy rates are used in place of *FEMP*, the coefficient is positive but no longer significant. The squared term for *LIT* is negative and significant.

## **CHAPTER 7. SUMMARY AND CONCLUSION**

Global food production is rising and it is increasing faster than population growth. However, it is evident that in many countries in the developing world, food consumption exceeds food production. Increases in global consumption of major food commodities have generally outpaced increases in yields for the past two decades. Thus, most of these countries are net importers of food. There is also an uneven distribution of food among and within countries.

Historical data indicate that the “availability gaps” among the regions of the developing world have become more pronounced, particularly in terms of food and nutrition. The data show that sub-Saharan Africa and Asia (South Asia in particular) are the two regions in the developing world that have the world’s poorest populations and the highest proportion of undernourished people. In both sub-Saharan Africa and South Asia, the proportion of undernourished increased during the past two decades. This is a clear indication that things are getting worse for a large segment of the developing world’s population. Unless appropriate policies are implemented, poverty will continue to rise, mostly in the African continent, but especially in sub-Saharan Africa, and a global food crisis may be inevitable.

The number of undernourished is expected to increase to 184 million in sub-Saharan Africa by 2015 (FAO 2000). Unlike Asia, where higher consumption will be covered by an increase in imports, the African region will not be able to meet food needs through higher imports. To meet the expected rise in food requirements, sub-Saharan Africa will need to increase agricultural production from the current 2 percent per annum (during 1970 to 1990) to 4 percent per annum for the next 20 years (USDA 1996). Furthermore, because of

reductions in assistance programs, food aid is not expected to fill the gap. The situation in Latin America, although critical in some areas, is expected to improve as food production exceeds population growth rates in the future.

There are differing hypotheses on why a majority of people in many developing nations face food security problems. Poverty, high population growth rates, urbanization, inappropriate national and economic policies, low agricultural productivity, and low investments in agricultural research and development are among the major reasons. The impact of food aid on the food situation in many of the developing countries has also been debated. Political rights and civil liberties as well as political instability have now become more important in discussions of solutions to the food security problems in the developing world. It is safe to suggest that a combination of all of these factors has contributed to the deteriorating food security situation in many countries. However, the debate continues on the priority given to, and the extent of, the effects of each of these factors in the food balance equation.

The primary purpose of this study was to examine whether the structure of political institutions in developing countries has had an impact on the level of food security or insecurity that these countries experience. The findings of the study indicate that in general, political institutions, measured in terms of political rights and civil liberties, have a definite impact on food security which was measured primarily in terms of per capita dietary energy supply. However, this impact comes indirectly through income as measured in terms of per capita GDP. Countries with freer political systems tend to enjoy greater incomes and in turn, greater food security than countries with less free systems.



The results also reveal that countries that have larger populations of agricultural labor tend to suffer from food insecurity. Investments in agriculture through applications of fertilizer have a positive effect on per capita dietary energy supply although the irrigation variable was negative and not significant.

High population growth and high fertility rates negatively impact per capita dietary energy supply. The results also show that higher per capita production of cereal positively impact per capita dietary energy supply. Official development assistance does seem to positively impact food security. The female literacy rate has a positive coefficient and so is positively correlated with per capita dietary energy supply. This implies that investments in education, and particularly female education, has a positive impact on food security.

### **Implications of the Study**

Food-deficit developing countries must make drastic policy changes in order to solve the problems of food availability and food access. Governments in developing countries must address food problems through policies that lead to economic growth that is also targeted toward poverty reduction; lower population growth rates; increased investment for agricultural research and development; higher investments in human capital through education and better health and sanitation services; increased employment opportunities and access to credit; and better infrastructure. Increases in food production are important to reduce domestic imbalances, but increased incomes for the poor are the real key to food security. These issues must be addressed within the framework of countries' political structures.

The results of this study indicate that the structure of political institutions in developing countries is an important but complex factor when determining the policies required to

eliminate food insecurity. It appears that high-income countries tend to have higher per capita dietary energy supply and thus enjoy food security. These high-income countries have freer political systems. The coefficient for partly free countries was not significant. For developing countries, policies that target economic sectors and aim to alleviate food insecurity are critical, regardless of their political structures. The official development aid given to developing countries clearly has a positive impact. Aid is positively correlated with per capita dietary energy supply. This implies that official development assistance tends to improve chronic food insecurity in recipient countries. This finding has significant policy implications although donor countries may need to re-evaluate the conditions under which foreign aid is given to developing countries.

Although the results have shed some light on the importance of political institutions in determining policies related to economic growth and food security, this study is primarily an empirical examination of the data. Detailed research is needed and more data is required to examine individual countries and regions. The transition economies are of a particular interest since they fall into a category between developed and developing countries. A more detailed study of the Asian economies may also present alternative hypotheses as to the importance of the type of political institutions. A closer examination of the measurement of political institutions is also required since a distinction should be made between the measurements of the quality of institutions and measurements of the political and social characteristics and political instability (Aron 2000). With more empirical evidence and establishment of stylized facts, theoretical models can then be constructed to explain the relationship between food security and political institutions.

**APPENDIX A. CHECKLIST FOR POLITICAL RIGHTS AND CIVIL LIBERTIES****Political rights checklist:**

1. Is the head of state and/or head of government or other chief authority elected through free and fair elections?
2. Are the legislative representatives elected through free and fair elections?
3. Are there fair electoral laws, equal campaigning opportunities, fair polling and honest tabulation of ballots?
4. Are the voters able to endow their freely elected representatives with real power?
5. Do the people have the right to organize in different political parties or other competitive political groupings of their choice, and is the system open to the rise and fall of these competing parties or groupings?
6. Is there a significant opposition vote, *de facto* opposition power, and a realistic possibility for the opposition to increase its support or gain power through elections?
7. Does the country have the right of self-determination, and are its citizens free from domination by the military, foreign powers, totalitarian parties, religious hierarchies, economic oligarchies or any other powerful group?
8. Is political power decentralized, allowing for local, regional and/or provincial or state administrations led by their freely elected officials?

**Civil liberties checklist**

1. Are there free and independent media, literature and other cultural expressions?
2. Is there open public discussion and free private discussion?
3. Is there freedom of assembly and demonstration?
4. Is there freedom of political or quasi-political organization?
5. Are citizens equal under the law, with access to an independent, nondiscriminatory judiciary, and are they respected by the security forces?
6. Is there protection from political terror, and from unjustified imprisonment, exile or torture, whether by groups that support or oppose the system, and freedom from war or insurgency situations?

7. Are there free trade unions and peasant organizations or equivalents, and is there effective collective bargaining?
8. Are there free professional and other private organizations?
9. Are there free businesses or cooperatives?
10. Are there free religious institutions and free private and public religious expressions?
11. Are there personal social freedoms, which include such aspects as gender equality, property rights, freedom of movement, choice of residence, and choice of marriage and size of family?
12. Is there equality of opportunity, which includes freedom from exploitation by or dependency on landlords, employers, union leaders, bureaucrats or any other type of denigrating obstacle to a share of legitimate economic gains?
13. Is there freedom from extreme government indifference and corruption?

Source: Ryan 1995, 673-674.

## **APPENDIX B. ECONOMIC FACTORS IN THE HERITAGE HOUSE INDEX OF ECONOMIC FREEDOM**

Economic factors used in the measurement of the index of economic freedom include:

*Trade policy:* average tariff rate, non-tariff barriers (such as import bans and quotas, strict labeling and licensing requirements, and burdensome health, safety, and environmental regulations), corruption in the customs services;

*Taxation:* top income tax rate, tax rate that applies to the average income level, top corporate tax rate, other taxes such as capital gains, value-added, and payroll taxes;

*Government intervention in the economy:* government consumption as a percentage of the economy, government ownership of businesses and industries, economic output produced by the government;

*Monetary policy:* average inflation rate from 1985 to 1995;

*Capital flows and foreign investment policy:* foreign investment code, restrictions on foreign ownership of business, restrictions on the industries and companies open to foreign investors, restrictions and performance requirements on foreign companies, foreign ownership of land, equal treatment under the law for both foreign and domestic companies, restrictions on the repatriation of earnings, availability of local financing for foreign companies;

*Banking:* government ownership of banks; restrictions on the ability of foreign banks to open branches and subsidiaries; government influence over the allocation of credit; government regulations, such as deposit insurance; freedom to offer all types of financial services, such as buying and selling real estate, securities, and insurance policies;

*Wages and price controls:* minimum wage laws; freedom to set prices privately without government influence; government price controls; the extent to which government price controls are used; government subsidies to businesses that affect prices;

*Property rights:* freedom from government influence over the judicial system; commercial code defining contracts; sanctioning of foreign arbitration of contract disputes; government expropriation of property; corruption within the judiciary; delays in receiving judicial decisions; legally granted and protected private property;

*Regulation:* licensing requirements to operate a business; ease of obtaining a business license; corruption within the bureaucracy; labor regulations, such as established work weeks, paid vacations, and maternity leave, as well as selected labor regulations; environmental, consumer safety, and worker health regulations; regulations that impose a burden on business;

*Black market:* smuggling; piracy of intellectual property in the black market; agricultural production supplied on the black market; manufacturing supplied on the black market; services supplied on the black market; transportation supplied on the black market; labor supplied on the black market.

Source: Johnson, Holmes and Kirkpatrick 1998.

## **APPENDIX C. INDICATORS IN THE FREEDOM HOUSE INDEX OF ECONOMIC FREEDOM**

Indicators used in the measurement of the Freedom House index of economic freedom:

*Freedom to hold property:* Is the right to property recognized by law? Is the right to intellectual property protected? Does the legal system give effect to the right to property?

Are there restrictions on selling, exchanging, or devising property? Can individuals structure their property holdings among themselves as they choose?

*Freedom to earn a living:* Can individuals form voluntary associations to bargain over wages? Are unions state-controlled? Are wages controlled or freely set? Can individuals change jobs freely? Are there any vestiges of indentured servitude, debt peonage, or slavery?

*Freedom to operate a business:* Can individuals freely join together to pursue mutual economic interests? Are the rules governing the formation of business enterprises so complex that large sectors of the population are foreclosed from forming businesses? Is entry into certain lines of commerce restricted? Are government contracts competitively let? Are raw materials, finished goods, services or other prices controlled?

*Freedom to invest one's earnings:* Are interest rates regulated? Is credit allocated by the market or by government fiat? Are rates of return on investments controlled? Can individuals invest abroad? Can they hold foreign currency and securities? Is there an independent central bank or other institutional mechanism to protect citizens' savings loss through inflation?

*Freedom to trade internationally:* Are there restrictive tariffs, quotas, or other barriers to importing goods from abroad? Are there export taxes or other impediments on the right to

sell to foreigners? Are there limits on the right to enter or leave the country? Is foreign investment regulated? Are there exchange controls?

*Freedom to participate in the market economy:* Are racial or ethnic minorities or women foreclosed from certain occupations or from running certain types of businesses? Are there limits on minorities' or women's rights to hold or transfer property? Are the laws necessary for a market economy to function enforced? Is corruption so widespread as to interfere with normal market forces?

Source: Messick, 1996, 7



**APPENDIX D. DESCRIPTION OF REGRESSION VARIABLES AND DATA  
INFORMATION**

Table D.1. Descriptive statistics of variables

NAME	N	MEAN	STANDARD DEVIATION	VARIANCE	MINIMUM	MAXIMUM
AGLAB	173	37.638	28.276	799.51	0.3675	94.115
AVGINF	163	196.93	898.41	8.07E+05	-1.996	8263.7
BIRTH	195	25.503	11.67	136.19	7.9	50.58
CEREAL	171	0.24504	0.31749	0.1008	0	1.9826
EDEBT	137	796.36	708.52	5.02E+05	12.411	3745
FEMP	165	91.2	14.306	204.67	40	112
FERTC	176	1982.8	5073.8	2.57E+07	0	52000
FRATE	193	3.414	1.7258	2.9783	1.16	7.4
GCON	150	0.19706	9.92E-02	9.84E-03	1.99E-02	0.61994
GCON1994	157	18.994	9.9443	98.889	2.363	60.698
GDP	157	5579.9	5693.9	3.24E+07	361.46	24031
GDP1980	156	5299.9	5960	3.55E+07	239.3	43622
GDP1991	158	5203.7	5063.0	0.25634E+08	325.56	20292
GDP1994	157	5429.2	5550.2	3.08E+07	349.3	23293
GDPGRT	159	0.44454	5.1337	26.355	-22.52	18.913
GINI	119	40.265	9.7121	94.325	20.5	62.3
GINV	172	23.085	10.302	106.13	5.1043	84.619
GINV94	169	22.704	11.411	130.2	0	85.042
HECF	153	3.249	0.79308	0.62898	1.25	5
INF	170	333.81	2211.2	4.89E+06	-3.0225	26791
IRRIG	155	20.611	25.568	653.72	0.13235	150
LABFRC	175	2.0074	1.2524	1.5686	-2.2952	5.4511
LABFRC1	175	44.357	6.8469	46.88	24.814	63.986
LIT	167	77.257	22.874	523.24	14	100
MILEXP	153	3.1739	3.3729	11.377	0	28.6
ODA	193	72.354	231.79	53727	-254.66	2004.1
POP	209	2.74E+07	1.10E+08	1.21E+16	17000	1.22E+09
PRCL	206	7.0485	4.1293	17.051	2	14
PRIM	167	93.467	22.23	494.18	23	142
SEC	176	54.682	32.108	1030.9	4	120
TRADE	154	33.957	36.805	1354.6	3.9471	282.21
TRADE94	153	33.41	37.292	1390.7	3.906	297.67
UPOP	194	53.26	23.539	554.08	5.8	100
XGRT	119	5.9954	6.475	41.926	-17.632	27.921
XPRT	171	38.117	25.193	634.71	1.1423	183.13

Table D.2. Definition and source of variables

Variable	Definition	Source
Arable land (hectares per person) ( <i>LAND</i> )	Land under temporary crops, temporary meadows for mowing or pasture, and land under market and kitchen gardens.	World Bank <sup>a</sup>
Cereal production (metric tons) ( <i>CEREAL</i> )	Cereals include wheat, rice, maize, barley, oats, rye, millet, sorghum, buckwheat, and mixed grains. Production data on cereals relate to crops harvested for dry grain only. They exclude cereal crops harvested for hay or harvested green for food, feed, or silage and those used for grazing.	World Bank <sup>a</sup>
Economic freedom ( <i>HECF</i> )	See section on "Discussion of some of the model variables" in Chapter 5	Heritage Foundation <sup>b</sup>
Export growth (%) ( <i>XGRT</i> )	Average growth of export of goods and services (1991-1995). Exports of goods and services represent the value of all goods and other market services provided to the world. Included is the value of merchandise and non-factor services.	World Bank <sup>a</sup>
External debt ( <i>EDEBT</i> )	Total external debt per capita in current US dollars	World Bank <sup>a</sup>
Female enrollment ( <i>FEMP</i> )	Female enrollment ratios in primary school as a percentage of men	World Resource Institute <sup>c</sup>
Fertility rate, total (births per woman) ( <i>FRATE</i> )	Represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with prevailing age-specific fertility rates.	World Bank <sup>a</sup>
Fertilizer consumption (100 grams per hectare of arable land) ( <i>FERTC</i> )	The quantity of plant nutrients used per unit of arable land. Fertilizer products cover nitrogenous, potash, and phosphate fertilizers (including ground rock phosphate). The time reference for fertilizer consumption is the crop year.	World Bank <sup>a</sup>
GDP growth (%) ( <i>GDPGRT</i> )	Average growth rate of real GDP per capita (constant 1987 US dollars) 1991-1995	World Bank <sup>a</sup>
Gini Coefficient ( <i>GINI</i> )	Measures inequality in the distribution of income	Deininger and Squire <sup>d</sup>
Government consumption (% of GDP) ( <i>GCON</i> )	General government consumption (1991-1995)	World Bank <sup>a</sup>
Gross domestic investment (% of GDP) ( <i>GINV</i> )	Average gross domestic investment as a percentage of GDP (1991-1995)	World Bank <sup>a</sup>
Gross Domestic Product (GDP) per capita, PPP	Gross National Product (GNP), purchasing power parity, current international prices	World Bank <sup>a</sup>
Literacy rate, adult total (% of people 15+) ( <i>LIT</i> )	The proportion of adults aged 15 and older who are literate	World Bank <sup>a</sup>
Inflation (average rate) ( <i>AVGINF</i> )	Average growth rate of GDP deflator (1987=100) (1991-1995)	World Bank <sup>a</sup>
Irrigated land (% of arable land) ( <i>IRRIG</i> )	The area purposely provided with water, including land irrigated by controlled flooding.	World Bank <sup>a</sup>

Source: <sup>a</sup> 1998 *World Development Indicators CD-ROM*, The World Bank (World Bank 1998); <sup>b</sup> 1999 *Index of Economic Freedom*, The Heritage Foundation (Johnson, Bryan T., Kim R. Holmes and Melanie Kirkpatrick 1998); <sup>c</sup> World Resources Database 1996-97; <sup>d</sup> Deininger and Squire 1996; <sup>e</sup> UNESCO Statistics Database 1999; <sup>f</sup> *The Sixth World Food Survey*, FAO (FAO 1996); <sup>g</sup> *World Survey of Economic Freedom*, The Freedom House (Messick 1998); <sup>h</sup> United States Department of Agriculture, Economic Research Services, 1998.

Table D.2. (continued)

Variable	Definition	Source
Labor force growth (%) ( <i>LABFRC</i> )	Average growth rate of the labor force (1991-1995)	World Bank <sup>a</sup>
Labor force in agriculture (%) ( <i>AGLAB</i> )	The proportion of the total labor force recorded as working in agriculture, hunting, forestry, and fishing	World Bank <sup>a</sup>
Military expenditure (% of GNP) ( <i>MILEXP</i> )	Military expenditure as a percentage of GNP	World Bank <sup>a</sup>
Official development assistance and official aid (US\$) ( <i>ODA</i> )	Official development assistance (ODA) consists of net disbursements of loans and grants made on concessional terms by official agencies of the members of DAC and certain Arab countries to promote economic development and welfare in recipient economies listed as developed by DAC. Loans with a grant element of more than 25 percent are included in ODA. ODA also includes technical cooperation and assistance. Official aid refers to aid flows from official donors to the transition economies of Eastern Europe and the former Soviet Union and to certain advanced developing countries and territories as determined by DAC. Official aid is provided under terms and conditions similar to those for ODA.	World Bank <sup>a</sup>
Per capita dietary energy supply ( <i>DES</i> )	Total food availability estimates obtained by aggregating the energy or nutritive values of the food component of commodities available for human consumption	FAO <sup>f</sup>
Political rights and civil liberties ( <i>PRCL</i> )	See section on "Discussion of some of the model variables" in Chapter 5	Freedom House <sup>g</sup>
Population, total ( <i>POP</i> )	Based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. Refugees not permanently settled in the country of asylum are generally considered to be part of the population of their country of origin.	World Bank <sup>a</sup>
Primary school enrollment ratio (%) ( <i>PRIM</i> )	Primary school enrollment (% gross) in 1991	World Bank <sup>a</sup>
Secondary school enrollment (%) ( <i>SEC</i> )	School enrollment, secondary (% gross) in 1991	World Bank <sup>a</sup>
Trade (% of GDP) ( <i>TRADE</i> )	Trade is the sum of exports and imports of goods and services.	World Bank <sup>a</sup>
Urban population (% of total) ( <i>UPOP</i> )	The midyear population of areas defined as urban in each country. It is measured as the percentage of the total population.	World Bank <sup>a</sup>

**Table D.3. World Bank data information**

---

**Data Information**

---

Data for China do not include Taiwan or Hong Kong.

Data for the former Czechoslovakia are for the Czech Republic and the Slovak Republic after 1991.

Prior to 1992, data for Ethiopia includes Eritrea for *EDEBT*.

Germany refers to unified Germany.

Data for Jordan refers to the East Bank only.

For the Soviet Union, data after 1991 is for Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakstan, Kyrgyz Republic, Latvia, Lithuania, Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan.

Data for the Republic of Yemen prior to 1990 is for the former People's Democratic Republic of Yemen and the former Yemen Arab Republic.

Data for Federal Republic of Yugoslavia is for Serbia/Montenegro. Data for individual countries of the former Yugoslavia (Bosnia and Herzegovina, Croatia, Macedonia, and Slovenia) are provided after 1990.

Data for Belgium includes Luxembourg for *LAND*.

---

---

## APPENDIX E. ADDITIONAL REGRESSION ESTIMATES

Table E.1. OLS Regression results for per capita dietary energy supply as the dependent variable for countries where DES is less than 2500 kilocalories per person per day

Right hand-side variable	Estimated Coefficient	Model (i)	Model (ii)	Model (iii) <sup>1</sup>
<i>AGLAB</i>	$\lambda_1$	-3.26 (-1.85) <sup>c</sup>	-3.35 (-1.99) <sup>c</sup>	-3.79 (-2.36) <sup>b</sup>
<i>UPOP</i>	$\lambda_2$	-----	-----	-----
<i>IRRIG</i>	$\lambda_3$	1.38 (0.97)	-----	1.94 (1.42)
<i>FERTC</i>	$\lambda_4$	0.07 (1.32)	0.07 (1.55)	0.07 (1.33)
<i>FRATE</i>	$\lambda_5$	26.73 (0.91)	2.76 (0.10)	74.24 <sup>i</sup> (2.24) <sup>b</sup>
<i>MILEXP</i>	$\lambda_6$	-26.18 (-2.42) <sup>b</sup>	-20.18 (-2.00) <sup>b</sup>	-27.28 (2.71) <sup>a</sup>
<i>ODA</i>	$\lambda_7$	0.86 (0.83)	0.94 (1.16)	0.91 (0.94)
<i>CEREAL</i>	$\lambda_8$	414.13 (1.71) <sup>c</sup>	367.19 (1.76) <sup>c</sup>	442.83 (2.00) <sup>b</sup>
<i>GDP</i>	$\lambda_9$	0.04 (1.96) <sup>c</sup>	0.03 (1.78) <sup>c</sup>	0.04 (2.05) <sup>b</sup>
<i>FEMP</i>	$\lambda_{10}$	-11.63 (-0.84)	-7.37 (-0.62)	-7.52 (-0.58)
<i>FEMP<sup>2</sup></i>	$\lambda_{10}$	0.06 (0.61)	0.02 (0.32)	0.03 (0.30)
<i>CONSTANT</i>	$\lambda_0$	2666.1 (5.51) <sup>a</sup>	2697.6 (6.38) <sup>a</sup>	2525.5 (5.48) <sup>a</sup>
$R^2$		0.55	0.50	0.60
$\bar{R}^2$		0.42	0.38	0.49
$N^d$		45	49	45

t-statistics are in parenthesis

<sup>a</sup> statistically significant at the 0.01 level<sup>b</sup> statistically significant at the 0.05 level<sup>c</sup> statistically significant at the 0.1 level<sup>d</sup> sample sizes differ between models because of missing data for some countries for different variables<sup>1</sup> *POPG* used instead of *FRATE*

Table E.2. Conventional 2SLS regression results for per capita dietary energy supply as the dependent variable

Right hand-side variable	Estimated Coefficient	Model (i)	Model (ii)	Model (iii) <sup>1</sup>
<i>AGLAB</i>	$\pi_1$	-7.69 (-3.41) <sup>a</sup>	-7.69 (-3.42) <sup>a</sup>	-7.68 (-3.41) <sup>a</sup>
<i>UPOP</i>	$\pi_2$	-----	-----	-----
<i>IRRIG</i>	$\pi_3$	-1.23 (-0.68)	-----	-0.33 (-0.17)
<i>FERTC</i>	$\pi_4$	0.06 (2.14) <sup>b</sup>	0.05 (2.08) <sup>b</sup>	0.07 (2.55) <sup>b</sup>
<i>FRATE</i>	$\pi_5$	-119.54 (-3.46) <sup>a</sup>	-115.18 (-3.41) <sup>a</sup>	-157.71 (-3.30) <sup>a</sup>
<i>MILEXP</i>	$\pi_6$	7.29 (0.56)	4.49 (0.36)	1.81 (0.14)
<i>ODA</i>	$\pi_7$	1.08 (1.86) <sup>c</sup>	1.11 (1.94) <sup>c</sup>	1.52 (2.41) <sup>b</sup>
<i>CEREAL</i>	$\pi_8$	158.70 (1.75) <sup>c</sup>	164.09 (1.84) <sup>c</sup>	192.46 (1.71) <sup>c</sup>
<i>GDP</i>	$\pi_9$	0.03 (2.67) <sup>a</sup>	0.03 (2.82) <sup>a</sup>	0.03 (2.62) <sup>a</sup>
<i>FEMP</i>	$\pi_{10}$	59.15 (2.94) <sup>a</sup>	59.07 (2.95) <sup>a</sup>	55.76 (2.66) <sup>a</sup>
<i>FEMP</i> <sup>2</sup>	$\pi_{10}$	-0.44 (-3.31) <sup>a</sup>	-0.44 (-3.30) <sup>a</sup>	-0.40 (-2.88) <sup>a</sup>
<i>CONSTANT</i>	$\pi_0$	1513.6 (2.10) <sup>b</sup>	1473.3 (2.05) <sup>b</sup>	1269.0 (1.68) <sup>c</sup>
$R^2$		0.74	0.73	0.71
$\overline{R}^2$		0.71	0.71	0.68
$N$		103	103	103

t-statistics are in parenthesis

<sup>a</sup> statistically significant at the 0.01 level<sup>b</sup> statistically significant at the 0.05 level<sup>c</sup> statistically significant at the 0.1 level<sup>1</sup> *POPG* used instead of *FRATE*

## REFERENCES

- Adelman, Irma. 1996. "Food Security and Poverty." Paper presented at the 1996 World Food Prize Symposium *Food Security: New Solutions for the Twenty-first Century*, October 17-20, Des Moines, Iowa.
- Adelman, Irma and Peter Berck. 1991. "Food Security Policy in a Stochastic World." *Journal of Development Economics* 34: 25-55.
- Adelman, Irma and Jairus M. Hihn. 1984. "Crisis Politics in Developing Countries." *Economic Development and Cultural Change* 33 (1): 1-22.
- Alamgir, Mohiuddin and Poonam Arora. 1991. *Providing Food Security for All*. International Fund for Agricultural Development (IFAD) Studies in Rural Poverty No. 1. New York, NY: New York University Press.
- Alexandratos, Nikos (editor). 1988. *World Agriculture: Toward 2000 – An FAO Study*. Rome: Food and Agriculture Organization of the United Nations and New York, NY: New York University Press.
- Alexandratos, Nikos (editor). 1995. *World Agriculture: Towards 2010 – An FAO Study*. Rome: Food and Agriculture Organization of the United Nations and West Sussex: John Wiley and Sons Ltd.
- Aron, Janine. 2000. "Growth and Institutions: A Review of the Evidence." *The World Bank Research Observer* 15 (1): 99-135.
- Baltagi, Badi H. 1995. *Econometric Analysis of Panel Data*. West Sussex, England: John Wiley and Sons Ltd.
- Baltagi, Badi H. 1998. *Econometrics*. Heidelberg, Germany: Springer-Verlag.
- Barro, Robert J. 1997. *Determinants of Economic Growth: A Cross-Country Empirical Study*. Development Discussion Paper no. 579 (April). Cambridge: Harvard University, Harvard Institute for International Development.
- Bates, Robert H. 1981. *Markets and States in Tropical Africa: The Political Basis of Agricultural Policies*. Berkeley and Los Angeles, CA: University of California Press.
- Beghin, John C. and Mylène Kherallah. 1994. "Political Institutions and International Patterns of Agricultural Protection." *The Review of Economics and Statistics* 76 (3): 482-489.

- Berck, P. and D. Bigman. 1993. "The Multiple Dimensions of the World Food Problem." In *Food Security and Food Inventories in Developing Countries*. Edited by P. Berck and D. Bigman. 1-33. Wallingford, UK: CAB International.
- Bigman, D. 1993. "The Measurement of Food Insecurity: Chronic Undernutrition and Temporary Food Deficiencies." In *Food Security and Food Inventories in Developing Countries*. Edited by P. Berck and D. Bigman. 237-251. Wallingford, UK: CAB International.
- Binswanger, Hans P. and Pierre Landell-Mills. 1995. *The World Bank's Strategy for Reducing Poverty and Hunger: A Report to the Development Community*. Environmentally Sustainable Development Studies and Monographs Series no. 4. Washington, D. C.: The World Bank.
- Birdsall, Nancy. 1994. "Macroeconomic Reform: Its Impact on Poverty and Hunger." In *Overcoming Global Hunger: Proceedings of a Conference on Actions to Reduce Hunger Worldwide*. Environmentally Sustainable Development Proceedings Series no. 3. Edited by Ismail Serageldin and Pierre Landell-Mills. 21-27. Washington, D.C.: The World Bank.
- Bollen, Kenneth A. 1980. "Issues in the Comparative Measurement of Political Democracy." *American Sociological Review* 45 (June): 370-390.
- Bollen, Kenneth A. 1990. "Political Democracy: Conceptual and Measurement Traps." *Studies in Comparative International Development* 25 (1): 7-24.
- Bongaarts, John. 1995. "Global and Regional Population Projections to 2025." In *Population and Food in the Early Twenty-first Century: Meeting Future Food Demand of an Increasing Population*. Edited by Nurul Islam. 7-16. Washington, D.C.: International Food Policy Research Institute.
- Cheng, Wei-Yuan. 1989. "Testing the Food-First Hypothesis: A Cross-National Study of Dependency, Sectoral Growth and Food Intake in Less Developed Countries." *World Development* 17 (1): 17-27.
- Christensen, Cheryl, Arthur Dommen, Nadine Horenstein, Shirley Pryor, Peter Riley, Shahla Shapouri and Herb Steiner. 1981. *Food Problems and Prospects in Sub-Saharan Africa: The Decade of the 1980's*. Foreign Agricultural Economic Report no. 166 (August). Washington, D.C.: Economic Research Service, United States Department of Agriculture.
- Collins, Joseph. 1991. "World Hunger: A Scarcity of Food or a Scarcity of Democracy." In *World Security: Trends and Challenges at Century's End*. A Project of the Five College Program in Peace and World Security Studies. Edited by Michael T. Klare and Daniel C. Thomas. 345-361. New York: St. Martin's Press.



- Dasgupta, Partha. 1995. "The Population Problem: Theory and Evidence." *Journal of Economic Literature* 33 (December): 1879-1902.
- Dasgupta, Partha and Martin Weale. 1992. "On Measuring the Quality of Life." *World Development* 20(1): 119-131.
- de Haan, Jakob and Jan-Egbert Sturm. 2000. "On the Relationship between Economic Freedom and Economic Growth." *European Journal of Political Economy* 16: 215-241.
- Deaton, Angus. 1993. *The Price of Power: Commodity Prices and Political Survival in Africa*. Working Paper IPR70 (December). Washington D.C.: Institute for Policy Reform.
- Food and Agriculture Organization of the United Nations (FAO). 1996. *The Sixth World Food Survey 1996*. Rome: FAO.
- Food and Agriculture Organization of the United Nations (FAO). 1998. *FAOSTAT*. FAO database on the World Wide Web <http://www.fao.org>. Rome: FAO
- Food and Agriculture Organization of the United Nations (FAO). 2000. *Agriculture: Towards 2015/30*. Technical Interim Report, April 2000. Rome: FAO.
- Foster, Phillips. 1992. *The World Food Problem: Tackling the Causes of Undernutrition in the Third World*. Boulder, Colorado: Lynne Rienner Publishers, Inc.
- Fosu, Augustin Kwasi. 1992. "Political Instability and Economic Growth: Evidence from Sub-Saharan Africa." *Economic Development and Cultural Change* 40 (4): 829-841.
- Gastil, Raymond Duncan. 1990. "The Comparative Survey of Freedom: Experiences and Suggestions." *Studies in Comparative International Development* 25 (1): 25-50.
- Green, Christopher and Colin Kirkpatrick. 1982. "A Cross-Section Analysis of Food Insecurity in Developing Countries: Its Magnitude and Sources." *The Journal of Development Studies* 18 (2): 185-204.
- Harrison, Ann. 1996. "Openness and Growth: A Time-Series, Cross-Country Analysis for Developing Countries." *Journal of Development Economics* 48: 419-447.
- Hwa, Erh-Chen. 1988. "The Contribution of Agriculture to Economic Growth: Some Empirical Evidence." *World Development* 16 (11): 1329-1339.
- Hsiao, Cheng. 1986. *Analysis of Panel Data*. New York, NY: Cambridge University Press

- International Development Research Centre (IDRC). 1992. *Our Common Bowl: Global Food Interdependence*. Ottawa, Ontario: IDRC
- International Policy Council on Agriculture, Food and Trade (IPC). 1996. "Attaining Global Food Security by 2025". A Policy Brief (December). Washington, D.C.: IPC
- International Service for National Agricultural Research (ISNAR). 1992. *Summary of Agricultural Research Policy: International Quantitative Perspectives*. The Hague: ISNAR.
- Jaeger, William K. 1992. "The Causes of Africa's Food Crisis." *World Development* 20 (11): 1631-1645.
- Johnson, Bryan T., Kim R. Holmes and Melanie Kirkpatrick. 1998. *1998 Index of Economic Freedom*. Washington, D.C.: Heritage Foundation/The Wall Street Journal.
- Judd, Ann M., James K. Boyce and Robert E. Evenson. 1986. "Investing in Agricultural Supply: The Determinants of Agricultural Research and Extension Investment." *Economic Development and Cultural Change* 35 (1): 77-113.
- Kirkpatrick, Colin and Dimitris Diakosavvas. 1985. "Food Insecurity and Foreign-Exchange Constraints in Sub-Saharan Africa." *The Journal of Modern African Studies* 23 (2): 239-250.
- Levine, Ross and David Renelt. 1992. "A Sensitivity Analysis of Cross-Country Growth Regressions." *American Economic Review* 82 (4): 942-963.
- Maxwell, Simon. 1997. "A Charter for Food Security." *Food Policy* 22 (6): 469-473.
- McCalla, Alex F. 1994. *Agriculture and Food Needs to 2025: Why Should We Be Concerned*. Sir John Crawford Memorial Lecture. Washington D.C.: Consultative Group on International Agricultural Research, The World Bank.
- McMillan, John, Gordon Rausser and Stanley R. Johnson. 1993. "Freedoms and Economic Growth: Transitional and Permanent Components." Working Paper 93-WP 115 (October). Ames, IA: Center for Agricultural and Rural Development.
- Mellor, John W. 1992. *Global Food Balances and Food Security*. Rural Development Studies no. 29. Uppsala, Sweden: International Rural Development Centre, Swedish University of Agricultural Sciences.
- Messick, Richard E. 1996. "World Survey of Economic Freedom, 1995-1996." In *World Survey of Economic Freedom, 1995-1996: A Freedom House Study*. Edited by Richard E. Messick. 5-18. New Brunswick, NJ: Transaction Publishers.

- Mitchell, Donald O. and Merlinda D. Ingco. 1995. "Global and Regional Food Demand and Supply Prospects." In *Population and Food in the Early Twenty-First Century: Meeting Future Food Demand of an Increasing Population*. Edited by Nurul Islam. 49-60. Washington, D.C.: International Food Policy Research Institute.
- Mitchell, Donald O., Merlinda D. Ingco and Ronald C. Duncan. 1997. *The World Food Outlook*. Cambridge, MA: Cambridge University Press.
- Murdoch, James C. and Todd Sandler. 1997. "The Voluntary Provision of a Pure Public Good: The Case of Reduced CFC Emissions and the Montreal Protocol." *Journal of Public Economics* 63 (3): 331-349.
- Murdoch, James C., Todd Sandler and Keith Sargent. 1997. "A Tale of Two Collectives: Sulphur versus Nitrogen Oxides Emission Reduction in Europe." *Economica* 64 (May): 281-301.
- Olson, Mancur. 1993. "Dictatorship, Democracy, and Development." *American Political Science Review* 87 (3): 567-576.
- Phillips, Truman P. and Daphne S. Taylor. 1991. "Background Paper on Food Security." Prepared for Canadian International Development Agency. Guelph, Ontario: Center for Food Security, University of Guelph.
- Pinstrup-Andersen, Per. 1994. *World Food Trends and Future Food Security*. Food Policy Report (March). Washington, D.C.: International Food Policy Research Institute.
- Pinstrup-Andersen, Per and Rajul Pandya-Lorch. 1998. "Recent Developments and Emerging Issues in World Food Security." *Choices* (Third Quarter): 4-7.
- Pinstrup-Andersen, Per, Rajul Pandya-Lorch and Mark W. Rosegrant. 1997. *The World Food Situation: Recent Developments, Emerging Issues, and Long-Term Prospects*. 2020 Vision Food Policy Report (December). Washington, D.C.: International Food Policy Research Institute.
- Przeworski, Adam and Fernando Limongi. 1993. "Political Regimes and Economic Growth." *Journal of Economic Perspectives* 7 (3): 51-69.
- Ruttan, Vernon W. 1987. *Agricultural Research Policy and Development*. FAO Research Policy Paper no. 2. Rome: Food and Agricultural Organization of the United Nations (FAO).
- Ryan, Joseph E. 1995. "The Comparative Survey of Freedom – 1994-1995 Survey Methodology." In *Freedom in the World: The Annual Survey of Political Rights and Civil Liberties 1994-1995*. Edited by Adrian Karatnycky et al. 672-677. New York: Freedom House.

- Scully, Gerald W. 1988. "The Institutional Framework and Economic Development." *Journal of Political Economy* 96 (3): 652-662.
- Sen, Amartya K. 1994a. "Freedoms and Needs: An Argument for the Primacy of Political Rights." *The New Republic* 210 (2, 3): 31-38.
- Sen, Amartya K. 1994b. "The Political Economy of Hunger." In *Overcoming Global Hunger: Proceedings of a Conference on Actions to Reduce Hunger Worldwide*. Environmentally Sustainable Development Proceedings Series no. 3. Edited by Ismail Serageldin and Pierre Landell-Mills. 85-90. Washington, D.C.: The World Bank.
- Serageldin, Ismail and Pierre Landell-Mills (editors). 1994. "Lessons of Experience: Twelve Case Studies." In *Overcoming Global Hunger: Proceedings of a Conference on Actions to Reduce Hunger Worldwide*. Environmentally Sustainable Development Proceedings Series no. 3. Edited by Ismail Serageldin and Pierre Landell-Mills. 165-202. Washington, D.C.: The World Bank
- SHAZAM 1993. SHAZAM Econometric Computer Program: User's Reference Manual Version 7.0 (Second Printing). Toronto, Canada: McGraw-Hill Book Company.
- Simmons, Ozzie G. 1988. *Perspectives on Development and Population Growth in the Third World*. New York, NY: Plenum Press.
- Simon, Julian L. 1992. *Population and Development in Poor Countries: Selected Essays*. Princeton, NJ: Princeton University Press.
- Sirowy, Larry and Alex Inkeles. 1990. "The Effects of Democracy on Economic Growth and Inequality: A Review." *Studies in Comparative International Development* 25 (1): 126-157.
- Smith, Lisa C. 1997. "The FAO Measure of Chronic Undernourishment: What Is It Really Measuring?" (unpublished manuscript).
- Studenmund, A. H. 1997. *Using Econometrics: A Practical Guide*. Addison-Wesley Education Publishers: Reading, Massachusetts.
- Thomson, Anne and Manfred Metz. 1997. *Implications of Economic Policy for Food Security: A Training Manual*. Training Materials for Agricultural Planning Series no. 40. Rome: Food and Agriculture Organization of the United Nations.
- Tweeten, Luther. 1998. "Anticipating a Tighter Global Food Supply-Demand Balance in the Twenty-first Century." *Choices* (Third Quarter): 8-11.

- Tweeten, Luther, John Mellor, Schlomo Reutlinger and James Pines. 1992. *Food Security*. Abridged and revised version of Food Security Discussion Paper PN-ABK-883 released in May, prepared for the United States Agency for International Development under supervision of the International Science and Technology Institute.
- UNESCO. 1999. UNESCOSTAT on the World Wide Web <http://unesco.org/unescostat>
- United States Agency for International Development (USAID). 1997. "Food Security in Africa Initiative: Executive Summary." Unpublished.
- United States Department of Agriculture (USDA). 1995. Food Aid Needs and Availabilities: Projections for 2005. An Economic Research Service Report GFA-6 (October). Washington D.C.: USDA.
- United States Department of Agriculture (USDA). 1996. *World Food Summit – Food Security Situation and Issues: A North American Perspective*. Washington, D.C.: USDA.
- United States Department of Agriculture (USDA). 1998. *Producer and Consumer Subsidy Equivalents Database*. Washington D.C.: USDA
- van de Walle, Nicolas. 1994. "Political Liberation and Economic Policy Reform in Africa." *World Development* 22 (4): 483-500.
- von Braun, Joachim. 1992. *Emerging Features of Absolute Poverty and Strategies for Its Rapid Reduction*. Rural Development Studies no. 29. Uppsala, Sweden: International Rural Development Centre, Swedish University of Agricultural Sciences.
- von Braun, Joachim, Howarth Bouis, Shubh Kumar, and Rajul Pandya-Lorch. 1992. *Improving Food Security of the Poor: Concepts, Policy, and Programs*. Washington, D.C.: International Food Policy Research Institute.
- Walters, Harry and Richard Bissell. 1994. "Overcoming Global Hunger: An Issues Paper." In *Overcoming Global Hunger: Proceedings of a Conference on Actions to Reduce Hunger Worldwide*. Environmentally Sustainable Development Proceedings Series no. 3. Edited by Ismail Serageldin and Pierre Landell-Mills. 127-145. Washington, D.C.: The World Bank.
- Webb, Alan J., Michael Lopez and Renata Penn (editors). 1990. Estimates of Producer and Consumer Subsidy Equivalents: Government Intervention in Agriculture, 1982-87. Economic Research Service Statistical Bulletin no. 803. Washington D.C.: United States Department of Agriculture.

- Webb, Patrick and Joachim von Braun. 1994. "Ending Hunger Soon: Concepts and Priorities." In *Overcoming Global Hunger: Proceedings of a Conference on Actions to Reduce Hunger Worldwide*. Environmentally Sustainable Development Proceedings Series no. 3. Edited by Ismail Serageldin and Pierre Landell-Mills. 203-218. Washington, D.C.: The World Bank.
- Weede, Erich. 1983. "The Impact of Democracy on Economic Growth: Some Evidence from Cross-National Analysis." *Kyklos* 36 (1): 21-39.
- World Bank. 1984. *World Development Report 1984*. New York, NY: Oxford University Press.
- World Bank. 1986. *Poverty and Hunger: Issues and Options for Food Security in Developing Countries*. A World Bank Policy Study. Washington, D.C.: The World Bank.
- World Bank. 1989. *World Development Report 1989: Financial Systems and Development*. New York, NY: Oxford University Press.
- World Bank. 1998. *1998 World Development Indicators CD-ROM*. Washington, D.C.: The International Bank of Reconstruction and Development/The World Bank.
- World Bank. 1999. *PovertyNet: Data on Poverty*. From the World Wide Web <http://www.worldbank.org/poverty/data/index.htm>. Washington, D.C.: The International Bank of Reconstruction and Development/The World Bank.
- World Resources Institute. 1996. *World Resources Database Diskette 1996-97: A Guide to the Global Environment*. New York: World Resources Institute.