Just Hungry?

Analyzing the Relationship between Land Concentration and Food Insecurity

by

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To Jonathon

for his endless support and steadfast belief in me,

and to

Aurora and Thandeka

for providing me with a wider perspective on life.

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List of Acronyms

ACC/SCN	UN Advisory Committee on Co-ordination, Sub-Committee on Nutrition
BMI	Body Mass Index
CV	Coefficient of Variation
DES	Dietary Energy Supply
DPT	Diphtheria, Pertussis, and Tetanus
FAO	United Nations' Food and Agriculture Organization
FAD	Food Availability Decline
FBS	Food Balance Sheet
GDP	Gross Domestic Product
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
KCAL	Kilocalories
LDCs	Less Developed Countries
MIT	Massachusetts Institute of Technology
OLS	Ordinary Least Squares
UNDP	United Nations' Development Programme
UNICEF	United Nations' Children's Fund
UNU	United Nations' University
WFP	World Food Programme
WHO	World Health Organization

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Abstract of the Dissertation

Chronic hunger is among the most serious problems in the developing world today. When we consider hunger's devastating effect on the health, welfare, and future prospects of the nearly 200 million children (or approximately 800 million people) that are chronically hungry, we realize that something has to be done.

Another serious problem concerns vast inequalities in access to agricultural land—a very important source of income and wealth in the developing world. Thus, after more than a decade in hibernation, land reform is back on the agenda in many developing countries. In the name of justice and rural poverty reduction, countries like Zimbabwe, Brazil, and South Africa hope to give the rural poor better access to agricultural land.

This dissertation investigates the potential for land reform as a means to reduce hunger in developing countries. Towards this end, it studies the relationship between land concentration and chronic hunger in the total population of 41 countries across the developing world. The study aims to establish whether countries with a more egalitarian distribution of land enjoy less hunger than countries where land is concentrated in the hands of the few. If this is the case, land reform could act as a means for reducing hunger.

I rely on an entitlement approach to the study of food insecurity, but see food availability as an integrated part of entitlement relations, mainly because of its effect on food prices. In particular, I devise a conceptual scheme over the complex relationship between land concentration and food insecurity among peasants, landless agricultural workers and industrial workers. This conceptual scheme builds on a dual economy perspective, and looks at the divergent effects of land concentration on the agricultural and the industrial sectors of the economy. A simplified model of this conceptual scheme is tested on the sample by way of multivariate regression analyses.

The most important finding of the study is that the effect of land concentration on food insecurity depends on the share of the population that relies on agriculture for a living, as well as the level of food availability in the country. These variables interact to produce very high levels of food insecurity in countries where there is a high level of land concentration, where a large share of the population depends on agriculture for a living, and where there is a low level of food availability. On the other hand, I find very low levels of food insecurity in countries with a high level of land concentration, where a low share of the total population depends on agriculture for a living, and where there is a high level of food availability. For this reason, I find both the highest and the lowest levels of food insecurity where land is concentrated in the hands of the few.

Another important finding of this study is that national food availability is much more important in relation to food insecurity than is usually assumed to be the case. For this reason the issue of food availability should be integrated more closely into the entitlement approach.

The dissertation (cautiously) concludes that very few countries are able to reduce their level of chronic hunger by implementing land reform. For most countries, land reform will most likely lead to more hunger. Moreover, by implementing land reform, countries (where land reform may help reduce food insecurity) may find themselves trapped in a situation with a medium level of food insecurity, from which it will be very hard to escape. This trap is a consequence of the low levels of agricultural labor productivity (and agricultural surplus available for industrialization) associated with a low level of land concentration.

1

Introduction

One of the most crucial issues of our time concerns the world's food insecurity problem. Each year, 11 million children under the age of five die from hunger and related diseases. Another way to conceptualize this is that on every fifth second, of every single day, the world suffers another child's death due to hunger. If this was not bad enough, these deaths are just the tip of the iceberg. In the developing world, there are about 200 million children under the age of five that suffer from chronic undernutrition. The United Nations' Food and Agriculture Organization (FAO) estimates that around 800 million people in the developing world are deprived of the necessary amount of food to support an active, healthy life. Some progress has been made over the past decades, but the problem continues to be overwhelming. The number of chronically hungry people in the developing world still constitutes more than the combined populations of the United States, Canada, Russia, France, Germany, the United Kingdom and Japan (FAO 2002a; WFP 2003).

Hunger affects the lives of these people in many ways. The most obvious effect is the agony associated with being hungry day after day. In addition, a lack of nourishment causes physical and mental stunting, and an increased susceptibility to disease. Worse, these conditions impair a person's ability to work and deprive him or her of the possibility for improving a desperate situation. Because hunger prevents the poor from taking advantage of development opportunities, it is both a cause and an effect of extreme poverty. Thus, hunger eradication is also a vital step in alleviating poverty and inequality (FAO 2003).

In 1996, participating countries at "The World Food Summit" agreed on a declaration to halve world hunger by 2015. At "The World Food Summit, Five Years Later" in 2002, it became evident that progress in hunger reduction had been much slower than anticipated. Unless the rate of hunger reduction nearly triples in the remaining years (until 2015), the goals of the World Food Summit will not be met (FAO 2003). Something needs to be done, and done quickly.

Hunger studies have traditionally explained food insecurity in terms of constraints on food production, and the (potential) misbalance between the growth in

food production relative to population growth. These studies belong to what has been called the *food availability approach*. Two main camps can be said to reside in this food availability approach. The first is a neo-Malthusian camp, which argues that hunger persists because there are too many people in the world compared to the earth's food production capacity. For this camp, population control is the only viable option for obtaining food security (Ehrlich 1969; Carson 1962; Brown and Kane 1994; Meadows et al. 1972 and 1991). The second camp argues that technological developments can boost food production enough to keep up with population growth for decades to come (Boserup 1965; Borlaug and Dowswell 1993; Hoell 1993; Daw 1994; Bumb 1995; Dyson 1996). The common denominator for both these camps, however, is that they believe hunger can be explained, and alleviated, in terms of food supply per capita.

In the 1980s, these explanations for food insecurity lost ground to an *entitlement approach* associated with Amartya Sen. This approach focuses on poverty and the *access* to food. In other words, food insecurity in the availability approach is a state of "there not *being* enough food"; in the entitlement approach, food insecurity is a state of "someone not *having* enough food". Thus, the entitlement approach cuts to the heart of the matter, which is that people do not have access to food because they are poor. This focus on access to food leads researchers from this approach to search for solutions in the direction of redistributing income and wealth (to the poor).

It is in this context that my contribution is situated. The aim of this thesis is to find out if land reform can reduce food insecurity by increasing entitlements to food among the poor. The impetus for this investigation is that there is a renewed focus on land reform as a poverty-alleviating policy in the developing world. Despite this renewed interest, the question of how land reform relates to food insecurity has not received much attention.

Since agriculture is a very important source of income and wealth in developing countries, and many of these countries have a highly inegalitarian distribution of land, land reform is often seen as an especially relevant policy for redistribution. Following successful land reforms in Japan, Taiwan and South Korea in the wake of World War II, the policy received a lot of attention in development circles and a new wave of land reforms swept across the developing world. In the

decades after 1950, extensive reforms were implemented in many countries in this part of the world. For example, in Latin America, countries such as Chile, Peru, the Dominican Republic, Venezuela, El Salvador, and Nicaragua have all tried their hand at land reform. On the Asian continent, India and the Philippines have made (at least) efforts towards extensive reforms; and in Africa, countries like Ethiopia, Tanzania, Zambia, Nigeria, Sudan, Uganda, Malawi, Guinea, and Kenya have carried out important land reforms. Many other countries across the developing world implemented more limited reforms in this period (Bruce 1998a; Adams 1995; Jazairy et al. 1992).

In the 1980s, however, land reform became a casualty of the new, neo-liberal development discourse. Although radical groups within the developing world still continued their struggle for land reform, the focus of the development discourse shifted to general economic growth (and trade). Land reform became "unfashionable"; the fruits of economic growth would now trickle-down to the poor—even where the control over land was concentrated in the hands of the few.

Today, land reform has been brought back onto the development agenda by international organizations such as the World Bank and the United Nations' Food and Agriculture Organization, as well as interest groups within developing countries. Zimbabwe's infamous land reform is the most striking manifestation of this renewed interest, but (less extensive and thus less renowned) land reforms are also underway in countries like South Africa and Brazil. This renewed interest in land reform is mostly a result of a growing belief that poverty cannot be alleviated without some redistribution of wealth and income (Alexandratos 1995: 318; Tyler et al. 1993: 3). In addition, there is a perception that small farms produce more per hectare than large farms, and that land reform will not only redistribute wealth and income, but also accelerate economic growth.[1] Finally, it is difficult to ignore the attractiveness of land reform as an issue of fairness or justice. In this light, land reform is driven by striking differences in living standards within a country. Pressures for land reform will always exist where there are great divides separating the rich landed elite from its poverty-stricken (and often landless) peasantry.

[1] This "inverse" relationship has been advocated by, among others, Bharadwaj (1974: 11-31) and Berry and Cline (1979).

Despite the (past and present) focus on land reform as a policy for alleviating poverty, the relationship between land reform and *food insecurity* is largely understudied. While there is a large body of literature on land reform as an instrument for reducing poverty (in general), very few consider the specific issue of food insecurity. The literature on (status quo) land concentration also focuses on poverty. While there are studies that focus on the relationship between land concentration and access (entitlements) to food (e.g., Jonsson 1993, von Braun et al. 1992; El-Ghonemy 1990; Thiesenhusen 1995), and a few of these pursue the link in empirical analyses—but focus solely on *rural* food insecurity (e.g., El-Ghonemy 1990; Amalgir and Arora 1991), nearly all of these studies are within-country case studies.

I am aware of only one cross-country study on the relationship between land concentration and food insecurity in the total population, and this is a very brief analysis in *The State of Food Insecurity in the World 2002* (FAO 2002a). This analysis of 25 developing countries shows that countries with low levels of land concentration have had better success in hunger reduction (during the 1980s and 1990s) than countries with high levels of land concentration. However, this study suffers from some serious shortcomings. In particular, the FAO study is a simple bivariate study that does not try to explain how low levels of land concentration might reduce food insecurity. Furthermore, the study does not control for other possible explanations, and it uses the FAO's data on undernourishment as an indicator for hunger. As I shall elaborate below in Chapter 3, this indicator is problematic for use in studies of land concentration in developing countries because the prevalence of hunger is, to a varying degree, estimated on the basis of information about land concentration.

Thus, there is a real need for a larger cross-country analysis that digs deeper into the dynamics of this relationship. This thesis aims to fill that gap. However, there is another gap in the literature on entitlements to food that this thesis seeks to fill. Existing studies aimed at increasing the poor's access to food have a tendency to focus myopically on income. In their eagerness to distance themselves from the availability *approach*, these studies overlook the important role that food availability plays for food prices, and thereby on the poor's real income (in terms of food). Thus, there is also a need for an analysis that considers concomitantly the income and price

sides of indirect entitlements to food. This is the second gap in the literature that this thesis seeks to fill.

In short, I want to find out whether countries with low land concentration have less food insecurity. If they do, land reform can be considered as a means for reducing food insecurity in countries with high levels of land concentration. While most studies on land concentration and reform focus exclusively on the consequences for the rural population, I want to investigate the effect on food insecurity in both agricultural and industrial populations. The reason for studying the relationship between land concentration and food insecurity in the *total* population is that I expect low levels of land concentration to generate low levels of food insecurity among the agricultural population, but relatively high levels of food insecurity in the industrial population. I expect this because the agricultural and industrial sectors are closely linked in developing (country) economies, as industrial growth depends on raw materials, food, and capital from the agricultural sector. With low levels of land concentration, self-consumption within the agricultural sector tends to be higher, and it is likely that the level of food availability (on the market) and the agricultural surplus necessary for industrialization will be lower (than if land concentration was higher). Thus, while the peasantry may enjoy higher food consumption (under low levels of land concentration), industrial workers may face lower incomes and higher food prices.

I conclude that land reform is not a very effective strategy for increasing food security in the vast majority of developing countries. For the few countries that might benefit from land reform, the reforms may actually trap them in a context with a medium level of food security. For the vast majority of countries, however, land reform may undermine existing levels of food security. Hence the title of this dissertation: *Just Hungry?* While many countries may be enticed to implement land reform in the name of distributional justice, the reforms themselves can increase the level of hunger in the country.

1.1 Method

While my aim is to assess the effectiveness of land redistribution as a policy for reducing food insecurity, I have chosen to study the relationship between food security and land *distribution*—instead of land reform. This is because the

concentration of land is the real issue at hand. Land reform is only important because it is a method for changing the distribution of land. It is therefore important to study how land concentration affects food insecurity. If there is no causal link between low levels of land concentration and (relatively) low levels of food insecurity, land reform will probably not be an effective policy for reducing food insecurity. (When we, in addition, consider the disruptions in productivity that often follow in the aftermath of land reform (Brigham 2000), there may be other policies that are better suited for reducing food insecurity in developing countries.) Because land reforms are difficult to compare across countries, there are strong methodological grounds for studying land concentration instead of land reform. Land reforms spring out of different agrarian structures; they have very different scopes (in terms of the size of the area redistributed and how many people benefit), as well as varying time spans. It is also difficult to find data on the extensiveness of the reforms (in reality, as compared to intent). At this stage of the investigation, a study of the relationship between land distribution and food insecurity will be more informative, and can encompass many more countries. However, when I study the relationship between land concentration and food insecurity, the rationale for land reform will be an implicit part of the analysis.

The concept of food insecurity encompasses both famine and chronic hunger. Famine is a situation characterized by a sudden collapse of the level of food consumption for a large segment of the population, leading to abnormally high rates of death from starvation (Sen 1981: 39-41). While famine can be understood as a temporary decline in access to food, chronic food insecurity is enduring. Chronic food insecurity implies a more continuous situation: victims have had (or risk having) too little to eat over extended periods, and deterioration in health (or even death) may result. Under conditions with chronic food insecurity, countries do not experience a stark increase in death rates from hunger. For this reason, famines are much more visible than chronic hunger, generating headlines in the world's press. Chronic food insecurity, by contrast, continues largely unnoticed. Some suggest that it is easier to eradicate famine than chronic hunger, because the latter is a problem that affects many more people and entails difficult social and political dimensions (Drèze and Sen 1989: 260-61).

Although there may be an evolutionary transition from chronic hunger to famine, they are best understood as two distinct phenomena. Both encompass starvation, but they imply different magnitudes, time spans, and (most often) different policy responses. While famines have a short (sudden) historical time-span, chronic hunger is not concentrated in time. And while death may be the final outcome of chronic hunger, famines lead to a more rapid deterioration of the victims' health and a stark increase in death rates from starvation. The focus of this thesis is on chronic hunger. Henceforth, when I use the terms food security and food insecurity they will refer to the chronic state.

There are three main reasons why I prioritize food insecurity over other indicators for poverty. First, food insecurity captures the most marginalized people: those who may not survive if their situation deteriorates. Second, there are millions of chronically food insecure people in the developing world, and the suffering of each and every one of these demands an end to the problem. Third, food security is important for combating general poverty and promoting economic growth in developing countries, as people who are chronically hungry cannot participate in productive work.

To test the empirical relationships between land concentration, food availability, and food insecurity I will undertake a cross-country, multivariate regression analysis on 41 developing countries. There are three main benefits from using a cross-country approach to this study of food insecurity. First, land concentration typically varies more across countries than within them (for example from region to region within a country). Second, land distribution and food availability variables are mostly observed at the national level. Third, a cross-country study can identify general patterns of relationships, and bring attention to causes and priorities for action that may be overlooked in single-country case studies.

There are two main concerns regarding the cross-country approach in this study: the availability and comparability of the data. Since developing countries cannot typically spend much of their limited economic resources on gathering data, there simply aren't available data for some of the variables that I would have liked to include in the analysis. Furthermore, the data on land concentration, for instance, are collected from several different sources, and therefore may not be directly comparable. Different sources may use a varying number of categories when they

compute their gini coefficients for landholdings. As a result, they may arrive at different coefficients for the same pattern of land distribution.

The remaining variables of this study are internally consistent as they rely on the same agencies (e.g., The World Health Organization (WHO), The World Bank, or The United Nations' Food and Agriculture Organization (FAO)) for all countries, but most of these data have been collected by the respective governments and sent to the relevant agencies. Thus, these data will also suffer from some degree of inconsistency across countries because different methods and standards may have been used. Across some variables there may be a compatibility problem in that different indicators come from different agencies; this is because they operationalize the same general concepts in different ways.

The indicator for food insecurity (my dependent variable) deserves special attention because I capture it by using the prevalence of stunting in children under five. There is some controversy about the applicability of this indicator. For this reason, I have dedicated Chapter 3 to a discussion of this indicator (and an alternative from the FAO), as well as the reasons for (and consequences of) choosing the prevalence of stunting.

I will use an interdisciplinary approach in order to understand as much of the phenomenon of food insecurity as possible. I venture into the discipline of economics, as much of the relationship between land concentration and food insecurity has to do with issues of labor productivity and its links to industrialization, as well as food prices in relation to the forces of supply and demand. I borrow from the field of "nutrition studies" in my discussion about measurements of food insecurity. Finally, I bring with me theories and methods from the discipline of political science (more specifically from comparative political economy) in my quest for the answer to "who gets what, when and how" in developing countries. Although any effort at interdisciplinary study is costly in terms of time and effort, these investments are necessary in order to understand how land concentration and food availability relate to food insecurity in the developing world.

In summary, I will rely on a framework borrowed from the entitlement approach. I then incorporate the issue of food availability into this approach and use this synthesized framework to study how land concentration affects chronic food insecurity in the developing world. By focusing on how land concentration relates to

food insecurity in the total population (and not only in the agricultural population), by incorporating food availability into the entitlement approach, and by testing the relationship in a cross-country, multivariate study, this thesis fills several important gaps in the literature on food insecurity and land concentration.

1.2 Map of the Thesis

In order to study the relationships presented above, the subsequent chapters will cover both theoretical and empirical territory. This section provides a road map for that territory, and a synopsis of the contents of each chapter.

The design of this thesis may appear somewhat unconventional. Given its exploratory nature, I use the first four chapters to provide necessary background information on the nature, measure, and existence of food insecurity in the developing world.[2] This background information is necessary before we can begin to address the complicated ways in which land concentration affects food insecurity. These relationships are then clarified in (first) a conceptual scheme and (then) a testable model. The empirical analysis follows in the latter part of Chapter 6, and in Chapter 7. The remainder of this section will expand on the contents of these chapters.

Chapter 2 discusses the two main approaches to the study of food insecurity: the food availability approach and the entitlement approach. I argue for the advantage of the latter because it focuses on the correct (individual) level of analysis. In addition, the entitlement approach guides us to search for the causes of food insecurity in the social, economic and political factors that determine people's access (or, in other words, entitlements) to food. Through the vehicle of "entitlement mappings", researchers can study how assets and income translate into (access to) food. The availability approach, with its focus on the level of per capita food supply, largely ignores these important questions.

On the basis of this discussion I settle on a definition of food insecurity as "inadequate access to enough food for a healthy and productive life."[3] This definition stands in contrast to a definition derived from the food availability perspective,

[2] It is commonplace to begin a dissertation with a literature review, which is followed by an explicit theoretical formulation, subsequent variable descriptions, and the analysis.

[3] This is the negative form of the World Bank's (1986) definition of food security.

where food insecurity is understood as a food deficit at the country, regional or world level.

Despite my dismissal of a food availability *approach* for studying food insecurity, I argue that food availability is important for food insecurity—through entitlement relations. In particular, food availability can influence people's access to food in that it affects the very price of food. By reviewing the previous literature on the entitlements to food, I find that the link between food availability and entitlements to food is understudied. Thus, I argue that food availability needs to be considered within the entitlement approach because of its influence on people's access to food.

In the first part of Chapter 3 I discuss how to measure chronic food insecurity (the enduring lack of entitlements to food). The two most relevant datasets on food insecurity in the developing world are the FAO's data on the prevalence of undernourishment (or, in other words, the access to food) and the WHO's dataset on child malnutrition (i.e., primarily the result of inadequate access to food, but also, to a lesser degree, the result of disease). These two datasets are juxtaposed and evaluated. Because the FAO's data on undernourishment are estimated on the basis of income distributions and per capita food supply, and because income distribution is often calculated from data on land distribution, these data suffer from a tautological relationship between land concentration and food supply. For this reason, I rely on the WHO's data (on the prevalence of stunting in children under the age of five) as my indicator for food insecurity. In any case, some researchers see these data as a more reliable indicator of food insecurity (than the FAO's data on malnourishment). However, the WHO's data also incorporate an element of disease, as stunting may result from both disease and inadequate access to food. The latter part of Chapter 3 is spent arguing that these data, nevertheless, can be used as a reliable indicator for food insecurity.

Having defined food insecurity as inadequate *access* to food, and chosen the prevalence of stunting (in children under five) as a satisfactory indicator for its prevalence in developing countries, Chapter 4 offers a description of the state of food insecurity across developing regions. This description reveals that there are about 180 million stunted children under the age of five in the developing world today. Most of these (about 130 million) can be found in Asia. However, when measured in

terms of the percent of the population (under five), Africa replaces Asia's discouraging place at the top of the list (with a prevalence of stunting just above 35 percent). Chapter 4 also describes the state of land concentration and a few related aspects of agrarian structures across the developing world. This part of the chapter reveals that land is generally most concentrated in Latin America and the Caribbean, and that the Near East and North Africa follows suit with lower levels of land concentration, tenancy, and landlessness. South East Asia and Africa have about the same (relatively) low levels of land concentration, but there is more landlessness and tenancy in the former.

In Chapter 5, I relate land concentration to food insecurity. In particular, I merge the largely separate literatures on food insecurity and land concentration, and arrive at a conceptual scheme for understanding the relationship between land concentration, food availability, agricultural labor productivity and the food insecurity of peasants, landless agricultural workers, and industrial workers. This discussion has a dual economy perspective. Thus, it focuses on how the linkages between the agricultural and industrial sectors of developing economies influence the relationship between land concentration and food insecurity.

Chapter 6 prepares the ground for an empirical test of that conceptual scheme. Because of data shortcomings, I cannot test all of the relationships outlined in Chapter 5. For this reason, I need to develop a testable model without compromising (too much of) the conceptual scheme's explanatory power. From the review of the entitlement approach literature in Chapter 2, I also include a number of control variables that may affect food insecurity (in addition to the variables derived from the conceptual scheme). In this chapter's latter part, I study the bivariate relationships between food insecurity and the variables that I expect to have a direct effect on food insecurity. These analyses show that land concentration is negatively correlated with food insecurity. This means that countries with high levels of land concentration generally had lower levels of food insecurity.

Once these bivariate relationships have been tested, the next step is to test the independent effects of the variables in a cross-country, multivariate regression analysis. This is done in Chapter 7. The results of the multivariate analyses show that land concentration influences food insecurity in different ways, according to the

share of the population that depends on agriculture for a living and the level of food availability.

The concluding chapter, Chapter 8, sketches the policy choices facing developing countries in varying contexts. This sketch reveals that land reform can only reduce food insecurity in countries where there is a (very) large share of the population that depends on agriculture for a living (combined with a low, or medium level of food availability). Under alternative conditions, land reform will probably *increase* food insecurity. However, by pursuing land reform, countries that can expect some reduction in food insecurity may find themselves trapped in a situation characterized by low levels of land concentration and a medium level of food insecurity. Under these conditions, there is little hope of short-term improvement. To the extent that the vast majority of food-insecure countries in Sub-Saharan Africa and South East Asia find themselves in just these conditions, this is a worrisome finding.

2

Availability and Entitlement

There are two main approaches to the study of food insecurity: the food availability approach and the entitlement approach.[1] This chapter provides an overview of these approaches, and an assessment of their merits and weaknesses in explaining hunger in the developing world. In Section 2.1, I provide an overview of the availability approach to food insecurity. In Section 2.2, I present the entitlement approach—the approach that dominates the debate today. In Section 2.3, I argue for the advantage of this perspective, mainly because it focuses on the correct level of analysis. In the following section, I review the entitlement approach literature with broad strokes, before using Section 2.5 to discuss the most important shortcomings with this literature and conclude that the previous research deals too lightly with the issue of food availability. Because food availability influences food prices, I argue that it needs to be integrated into the entitlement approach. I summarize the chapter's argument in Section 2.6.

2.1 The Food Availability Approach

The food availability approach dominated academic debate on food insecurity from the 19th century until it was challenged by the entitlement approach in the 1980s. This section describes the availability approach. An important critique of this approach is advanced by the entitlement approach, which will be dealt with in the next section.

The food availability approach derives its name from a focus on how much food is available in a society. Food insecurity is assessed by comparing the amount of food available in an area to the minimum amount necessary (to feed all of its inhabitants). This can be done at the global, regional, and/or national levels.[2] At the global level, food insecurity aims to measure whether the earth can produce enough food to feed its entire population. Regional and national food insecurity is evaluated

[1] When applied to famines, the first approach is called the food availability *decline* approach (FAD).

[2] If not otherwise stated, a region is applied to groups of countries (for example Latin America and the Caribbean) and not to the sub-national level.

by comparing actual food supplies to respective sustenance requirements. As food *supply* incorporates production, imports and exports, it is possible to have full food security (from a food availability perspective) in a country that has no domestic food production (provided that there is enough foreign exchange to import the needed food). Conversely, a country that produces more than enough food (relative to its population) can be food insecure (again, from a food availability perspective) if much of that food is exported (and imports are not large enough to make up the difference).

Within the food availability approach there are two main schools of thought. The neo-Malthusian school suggests that the current (and future) problem is one of too many people in the world, compared to the natural resources available for food production. Since the Second World War, when population growth accelerated in many parts of the developing world, there has been widespread concern that it would not be possible to produce enough food for this rapidly growing population. Adherents to this school argue that the hunger problem will persist, or even explode, because we are about to reach absolute limits to food production. Intensive agricultural methods have already deteriorated the earth's resource base, and the remaining reserves are insufficient for supporting an increase in food production large enough to provide for the world's rapidly increasing population. This is being argued at a time when the world's population is estimated to increase by 50 percent during the next 50 years.[3] From this perspective, solving the world's hunger problem lies in controlling population growth (e.g., Ehrlich 1969; Brown and Kane 1994; Carson 1962; and Meadows et al. 1972 and 1991).

The contending school of "technology optimists" does not see things quite so gloomily. This school argues that there is no need to panic: calls for population control are unnecessary as the future holds an almost limitless potential for increasing food production. These optimists believe that the developing world's hunger problem can be solved because the current tension between the growth rates of population and food production is temporary; it will soon be relieved by technological developments. With reference to the unused potential of the Green

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[3] The UN medium projection is that the world's population will rise from 6.1 billion in 2000 to 9.3 billion by 2050 (UN 2001).

Revolution, and to recent developments in the field of biotechnology, they argue that we are far from approaching the limit to the earth's capacity to increase food production levels (e.g., Dyson 1996; Hoell 1993; Borlaug and Dowswell 1993; Bumb 1995; and Daw 1994).

From this perspective, the Green Revolution provided an end solution to hunger; technology would enable food production to grow significantly faster than the population. In the wake of the Green Revolution, there was widespread optimism about the new high-yielding varieties of food grains and increased use of fertilizers, and it was suggested that famine and undernutrition would be eliminated within a decade (Geier 1996: 10-12). But after several decades, the hunger problem remains far from resolved. In 1988/90, for instance, the world's food production was more than high enough to adequately feed all of its inhabitants; still, there were more than 790 million chronically undernourished people in the developing world (FAO 1999: 29).

2.1.1 A Long Standing Debate among Pessimists and Optimists

We are not the first generation to be concerned with massive starvation, rapidly escalating population growth rates, and the earth's ecological carrying capacity. Nor is ours the first generation to offer retort by technological optimists. This debate between optimists and pessimists, as sketched above, has deep historical roots.

Arguments about natural limits to the earth's carrying capacity have a long pedigree. As distantly as the sixteenth century, Giovanni Botero argued that the world population's growth rate exceeded the earth's natural capacity to provide it with food. Botero claimed that:

> "Populations tend to increase, beyond any assignable limit, to the full extent made possible by human fecundity: the means of subsistence, on the contrary, and the possibilities of increasing them are definitely limited and therefore impose a limit on that increase, the only there is; this limit asserts itself through want, which will induce people to refrain from marrying unless numbers are periodically reduced by wars, pestilence and so on" (as quoted in Schumpeter, 1994: 254-55).

Having survived nearly four hundred years of criticism, this theory is still frequently used to explain the world's hunger problem. It is not Botero, however, but the late eighteenth century priest and scientist Thomas Robert Malthus (1766-1834) who is best know as its sponsor.

Malthus' prominence originates from a famous debate in late eighteenth century Britain, on the prospects of improving future society. At the time, Britain was experiencing a population explosion that fuelled worries of a growing mismatch between people and resources. Consistent with the period's enlightenment spirit, this pessimism was quickly countered by more uplifting responses. Contemporary optimists could point to breakthroughs in technology and human understanding: developments that could create a much more equitable world, free of starvation and disease (Jensen et al. 2003).

Among these optimists was the Marquis de Condorcet (1743-94). Condorcet was confident that the problem of over-population would be solved with reference to human reason. Productivity increases, he believed, would increase man's potential livelihood, as "a very small amount of ground will be able to produce a great quantity of supplies of greater utility or higher quality" (quoted in Sen 1994b: 74). In addition, Condorcet held that education would bring lower birth rates, as rational human beings would see the value of limiting family size, giving their children the prospect for longer and happier lives. Reason, the optimists argued, would secure a better balance between people and food (Kennedy 1993; Sen 1994a and 1994b: 74).

The optimism of Condorcet and others provoked Malthus to publish a legendary text on the dynamics of hunger. In his *Essays on the Principle of Population* [1798], Malthus argued that the power of population is indefinitely greater than the power of the earth to produce for man's subsistence:

> "Population, when unchecked, increases in a geometrical ratio. Subsistence increases only in an arithmetical ratio. A slight acquaintance with numbers will show the immensity of the first power in comparison of the second...This implies a strong and constantly operating check on population from the difficulty of subsistence. This difficulty must fall some where, and must necessarily be severely felt by a large portion of mankind" (Malthus 1993: 13).

Malthus argued that populations would always grow until they reached or surpassed a food production limit imposed by the earth's limited ecological capacity. Even if there were no absolute limits to the earth's potential output, the varying rates of increase (between population and food production) would soon lead to an imbalance between people and food. This imbalance would impose certain checks on the population's growth; checks that were either of a positive or negative sort. Positive checks—like starvation, violence and war—would act by increasing the

death rate: repressing growth rates which were already too large. Negative checks or "moral constraints" would act by decreasing the birth rate: refraining people from having children that they could not possibly support (Malthus 1993: 16). Inevitably, both checks could be traced back to the problem of insufficient food supplies.

For Malthus, the only feasible check on population growth was derived from a population's potential lack of subsistence, or the fear of such. Social reforms or revolutions would only magnify the problem: improving the conditions for population growth (because the checks on population growth would be removed), but without affecting the earth's capacity to produce enough food.

2.1.2 The Debate Renewed

As a result of the first agricultural revolution,[4] the industrial revolution, and emigration—eighteenth century Britain managed to escape from the "Malthusian Trap" (Kennedy 1993). But the debate which Malthus spawned has been with us ever since. Even today one can find Malthus' and Condorcet's after-followers.

A contemporary version of Malthus' argument became popular in the aftermath of the Second World War. At the time, the world's poorest regions were experiencing a rapid increase in population growth rates, while their food production rates were growing relatively slowly. In this context, Malthusian theories experienced a renaissance. Neo-Malthusians came to argue (in very stark terms) that the world's population was about to surpass the carrying capacity of the earth. This, they argued, would lead to a major hunger catastrophe.

At about the same time, Rachel Carson inspired the growth of an environmental movement with her classic book, *Silent Spring* (1962). *Silent Spring* opened the world's eyes to the devastating environmental consequences of modern agriculture's growing dependence on chemicals. In so doing, Malthusian theory reappeared in a new guise. Not only was the population in danger of increasing faster than the food necessary to sustain it, but modern attempts at trying to increase food production rates were also bought at great environmental cost. Because of environmental degradation, people were being forced to move (continually) to new areas in order to avoid starvation. In turn, these areas would also become depleted. In

[4]This agricultural revolution consisted mainly in the introduction of crop rotation, new breeding techniques, better management, new equipment, clover, turnip and the potato, and the enclosure movements (Jones 1974).

the view of these neo-Malthusians, population growth was like a cancer: if it weren't stopped it would destroy the planet and (consequently) all of its inhabitants (Ehrlich 1969; Meadows et al. 1972).

In another classic book, *The Population Bomb*, Ehrlich (1969: 7) advocated a Malthusian position by suggesting that attempts at trying to provide enough food for everyone were destined to fail. Current levels of agricultural and industrial production had already surpassed the earth's ecological capacity. Attempts at satisfying the needs of the current population were resulting in the depletion of natural resources and the pollution of the environment. Ehrlich argued that the inevitable global food shortage was only a symptom; the real problem was that there were too many people on a dying planet.

Although Ehrlich realized that programs could be developed to expand the earth's food production capacity, he argued that these could only offer temporary solutions. Based on this, Ehrlich developed a policy prescription for food aid to the developing world. Since the earth's carrying capacity to produce food had already been surpassed, food should not be given to those countries that were unable to attain self-sufficiency. Instead, food aid should only be given to generally self-sufficient countries that were overcoming immediate and/or urgent food crises. Helping other countries would simply be a waste of scarce resources (Ehrlich 1969: 103-5).

At the Massachusetts Institute of Technology (MIT), an international group of scholars led by Dennis Meadows developed a computerized model to examine possible scenarios given various trends in population, industrialization, food supply, and the depletion of nonrenewable resources.[5] In their model, population growth and industrialization were the main driving forces. The most significant constraints were seen to be arable land, nonrenewable resources and pollution. The main conclusions of the Meadows' study were as follows: if present trends continued, the "limits to growth" would be reached within the next hundred years. The accompanying result would be a sudden, uncontrollable drop in the world's population. Meadows concluded that such a catastrophe could be avoided if industrialization and population growth rates were moderated, and intensive recycling programs (of resources) and a radical reorientation of values (from industrial to food production)

[5]This research was conducted as a part of The Club of Rome's project on "The Predicament of Mankind".

were adopted immediately (Meadows et al. 1972). The group's findings were published in a path-breaking book, *The Limits to Growth* (1972), which made headlines throughout the world, promoting heated debates (Cornish 1977: 243-4).

In response to the many criticisms of *The Limits to Growth*, the authors published a follow-up book entitled *Beyond the Limits* (1991). This book is quite similar to *The Limits to Growth*; it deals with the same trends and forces, and uses the same (but improved) computer model. In addition, *Beyond the Limits* updates the study to include evidence from the twenty years that had passed since their first study. Their conclusions are generally similar, although they contain even stronger predictions of doom: the world has already reached some of its limits, and a significant reduction in the world's resource and energy flows is necessary.

One of today's best-known advocates of the Malthusian position is Lester Brown of the World Watch Institute. In *Full House* (1994), Brown and Hal Kane estimate the earth's population carrying capacity to be about 5.5 billion. As a result, they argue that large parts of today's developing world are caught in a demographic trap:

> "Once populations expand to the point where their demands begin to exceed the sustainable yields of local forests, grasslands, croplands, or aquifers, they begin directly or indirectly to consume the resource base itself. Forests and grasslands disappear, soils erode, land productivity declines, water tables fall, and wells go dry. This in turn reduces food production and incomes, triggering a downward spiral in a process we describe as the demographic trap" (Brown and Kane 1994: 55).

As was the case in the eighteenth century, however, contemporary optimists can also be found. For members of this school, technological innovations in agriculture have rescued the world from another "Malthusian Dilemma". Esther Boserup, one of the foremost optimists of the time, argued in her now classic *Conditions for Agricultural Growth* (1965), that the direction of the causal arrow (between population and food production growth trends) was the opposite of what was claimed by Malthusians—both new and old. Thus, Boserup argued that population growth (which was determined by biological, medical and political factors) leads to increased agricultural output. This stands in stark contrast to the traditional argument: that the limits to agricultural growth were decisive for determining the population's growth and decline.

Julian Simon adopted an even more optimistic view when he claimed that the balance between population and resources was actually improving, and that this positive trend was likely to continue (Simon 1981; Gilbert 1993: xxiv). Simon promoted an anti-Malthusian population theory—where rising standards of living are the result of increased productivity rates. Increasing productivity, in turn, is dependent upon technological progress, which in turn relies on the number of human minds. As the population increases we have access to more minds, and with them, improved standards of living. It is within this optimistic perspective that the advocates of the Green Revolution could be found.

In summary, Brown and his fellow travelers—like Malthus and Botero before them—stress the importance of reducing population growth rates as a means of solving today's hunger problems. Contemporary optimists, predictably, stress the importance and hope of technological developments. This debate seems stuck in an eternal loop, where population growth is set off against technology and the earth's capacity to produce enough food.[6]

In the early 1980s a new perspective on food insecurity emerged. This perspective questioned the narrow focus on food production and supply in comparison to population, suggesting that poverty was the main reason for hunger. Furthermore, it directed our attention to people's *access* to food, and how this depends on the economic, political and social structure of society, and the individual's position in it (Sen 1981: 46). The question of who has access to the food produced is central to the entitlement approach, to which we will now turn.

2.2 The Entitlement Approach

With the entitlement approach came a new vision about hunger in the developing world, a vision focused on poverty as the main cause of food insecurity. While poverty had not been entirely absent from the earlier debate, it was not until the advent of Sen's "entitlement approach" that this aspect took center stage. Sen introduced this approach in response to the more popular Malthusian-based explanations for starvation, and he was particularly critical of the argument that famines were blamed on natural disasters that caused harvest failures. In contrast to

[6] I have elaborated on this shortcoming of the neo-Malthusian debate in Brigham (2003a).

the rather technical and demographic determinism of the availability approach, Sen's approach investigates why some groups of people have more than enough to eat, while others starve. In particular, the entitlement approach is concerned with determinants of the distribution of food between different groups in society. It sees starvation as a function of people's access to (ability to produce, buy or otherwise command) the food they need, concentrating on how legal systems allow some people to starve while others live amongst plenty (Sen 1980, 1981).[7]

There are three basic building blocks to the entitlement approach. These are endowments, entitlement mapping, and the entitlement-set.

- *Endowments* are all legal resources that can be used to obtain food.[8] These resources include money, land, machinery and animals, but also more abstract resources such as labor power, "know how", kinship and citizenship (Sen 1981).
- *Entitlement mapping* (or E-mapping) is the terms of trade between endowments and food, goods and services (Sen 1981: 46). This materializes in, for example, the ratio between money wages and the price of food, or the input-output ratios in farm production (Osmani 1995a: 255).
- The *entitlement-set* represents the basket of food, goods and services that a person can obtain using his/her endowments.

There is a whole spectrum of ways to convert endowments into an entitlement-set. Sen has dichotomized these into what he calls direct and indirect entitlements. Direct entitlements cover the production of food for one's own consumption. Indirect entitlements include a person's purchasing power to food (obtained through wage labor, selling commodities, exchange for other commodities, etc.) as well as a person's right to food derived from social security programs, inheritance or other

[7] Mitra (1982: 488) argues that: "[Sen] has not said anything beyond what our great grandmothers were already aware of." It is not difficult to agree that there is a strong element of common sense in Sen's argument. However, the novelty of the approach lies in the fact that it was forwarded in a systemized and formalized fashion by a renowned economist. For these reasons, it was able to challenge the availability approach. Even if most great grandmothers understood that starvation is caused by poverty, Sen's language and systematic presentation of the entitlement approach were responsible for introducing poverty into the contemporary academic and political debate on hunger.

[8] Sen does not consider illegal means for obtaining food, such as stealing or looting (Sen 1981: 49). According to Osmani (1995a: 254), legal means have to be interpreted in broader terms as social norms and practices, not confined to what is formally sanctioned by the state.

legal arrangements. Some groups may rely on both types of entitlements. For example, peasants may need to exchange some of their produce for other types of food that provide more calories, proteins etc., at a lower cost. Others may need to seek additional work outside the farm to supplement what they are able to grow themselves (Sen 1981: 45-51).

In other words, deterioration in a person's food security can be traced to a reduction in endowments and/or deterioration in the exchange rate (E-mapping) between the endowments and the entitlement-set. Thus, this approach directs the search for causal explanations at the forces that determine people's command over food. This stands in contrast to the availability approach, which focuses on what determines the level of per capita food supply.

Sen explicitly dismisses food shortages/misbalance between population and food availability as the principal cause of starvation. To show this, he draws on four famines in the twentieth century. In at least three of the four cases, Sen shows that food availability did not decline and that the famines must be explained by other factors than a shortage of food.

For example, during the Great Bengal Famine in 1942-43, Sen (ibid: 78) showed that food availability was the highest in Bengal's history. Despite this, over 1.5 million people died during the famine. Sen claims that these deaths resulted from a movement in exchange entitlements to food in disfavor of the hardest hit groups of agricultural laborers and fishermen. The wholesale price of rice (which was the staple food) rose from between Rs. 13 and Rs. 14 in December 1942 to Rs. 37 in August 1943 (ibid: 66). The reason for this movement was not a shortage of food, but two war-related developments: inflationary pressure initiated by an expansion of public expenditures, and speculative and panic hoardings of rice. While some groups were able to increase their purchasing power in pace with the price increases (e.g., those involved in military and civil defense works, the army, in industries and commerce stimulated by war activities, others (especially agricultural workers) were not (Sen 1981: 75-78). Thus, it was a worsening in the latter groups' E-mappings that made them starve, not an absolute shortage of food.[9]

[9] There has, however, been a great deal of debate about the empirical studies that Sen has undertaken. For example, studies by Seaman and Holt (1980) and Cutler (1984) have indicated that the food availability decline during the Wollo famine (in Ethiopia) of 1972-74 was more severe than acknowledged by Sen.

Because Sen's empirical work has mostly concentrated on famine situations, the entitlement approach is commonly perceived to apply only to famines, not to chronic hunger. This is a misunderstanding. In his now legendary book, *Poverty and Famines* (1981), Sen points out that his approach can be used to find explanations for both chronic food insecurity and famines: "The main focus of this work is on the causation of starvation in general and of famines in particular" (ibid: vii). Later, in *Hunger and Public Action,* Drèze and Sen (1989) analyze situations of both chronic hunger and famines with the entitlement approach:[10]

> "The two forms of calamity related to hunger with which this book is concerned are (1) famines, and (2) endemic undernutrition and deprivation. The distinction between the intermittent and explosive occurrence of famines and the quieter and persistent phenomenon of regular undernutrition is important both from the point of view of diagnosis (they have different features and often quite dissimilar causal antecedents) and that of action (they call for substantially distinctive policies and activities)" (Dréze and Sen 1989: 260).

This does not mean that we will (necessarily) find the same causes for both phenomena. Rather, I believe that we will find different answers along the lines of endowments, E-mappings and entitlements.

2.3 The Benefits of the Entitlement Approach

The concept of food security can be applied to various levels of analysis: global, regional, national, household and individual. At the global level, food security aims to measure whether the earth can produce enough food to feed its entire population. The value of studying global food availability (per capita) is vested in the fact that it is a *precondition* for food security at all of the other levels: if there is a global food shortage, some people will necessarily suffer from malnutrition.

In a similar manner, regional and national (per capita) food availability measures whether there is enough food in a region or a country, given the respective sustenance requirements. Like global food availability, these regional and national aggregations are important for measuring the overall limits of food security. However, these aggregates measure food security by the average amount of calories, proteins and/or carbohydrates that is available per capita compared to average per

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[10] All of part III in the book is concerned with chronic hunger.

capita *needs*. They do not measure food insecurity in terms of how much people really have at their disposal. In other words, these aggregations do not give any information about how the food is distributed, and how many people (if any) do not get enough to eat.

Measured at these levels of aggregation, food security (in terms of per capita food supply) provides no guarantees against hunger and starvation. Starvation only occurs at the individual level; a country or a region, or for that matter the globe, cannot feel hunger or the consequences of hunger. Sufficient overall food availability is thus a necessary, but not sufficient, condition for food security. For this reason, we need to address the real problems of world hunger at the individual level.

Table 2.1: Food Requirements, Food Supply and Chronic Hunger, by Developing Region

	Min. Energy Requirement	Per capita DES	Stunting %
Latin America & Caribbean	1870	2740	23
Sub-Saharan Africa	1800	2040	38
Near East and North Africa	1840	2960	32
East and Southeast Asia	1880	2680	33
South Asia	1790	2290	60

Notes: Minimum energy requirement (in kcals per person per day) varies by region according to their age and sex composition. DES means dietary energy supply, and is also measured in kcals per person, per day. The prevalence of stunting refers to the percent of children under five, and is a WHO measure that indicates chronic food insecurity (as opposed to acute food insecurity, which is indicated by wasting) (WHO 2000: 4-5). Data on minimum energy requirement and per capita DES are from 1990-92, while data on the prevalence of stunting are from 1990.

Sources: The source of Minimum Energy Requirement is FAO (1996: 53). Data on DES are taken from FAO (1996: 11). Data on Stunting are from the World Health Organization (WHO), and come from FAO (1996: 69).

The importance of using the correct level of analysis can be illustrated by the following (empirical) example. In Table 2.1 we see that there was more than enough food in each of the developing regions to feed all of their inhabitants in 1990-92 (contrast column two with column one). Despite these conditions at the regional level, millions of people suffered from chronic hunger during the same period. In this table, chronic hunger is captured by the percentage of the population (under five years in age) that is stunted.[11] It is evident that we cannot draw the conclusion that everyone gets enough to eat on the basis of data on regional food supplies. The same

[11] See Chapter 3 for a discussion of this indicator.

methodological inadequacy is present when food security is assessed from global and national data.

Recognizing the importance of the individual-level concept, the World Bank has defined food security as "access by all people at all times to enough food for an active, healthy life" (World Bank 1986: 1). In line with the World Bank, The United Nations' Development Programme has defined food security in terms of "sustained and assured access by all social groups and individuals to food adequate in quality and quantity to meet nutritional needs" (UNDP 1994: 27).[12] Thus, food insecurity means that some people, sometimes or always, have inadequate access to enough food to live a healthy and productive life. The FAO (2002a) has defined food insecurity as "when people must live with hunger and fear starvation". These are much stricter definitions of food security and insecurity than we find at the higher levels of analysis. The World Bank's, the UNDP's, and the FAO's definitions of individual level food security not only require that there is enough food to go around; they also require that people have access to the food that they need. As a result, we can find individual food insecurity in areas where there exists food security at higher levels of aggregation. In short, global, regional and national food securities are preconditions, but not guarantees, for individual food security. Thus, from here on, when I use the terms food security and food insecurity they refer to the individual-level concepts.

Despite the fact that the World Bank's definition of food security refers to the individual's access to food, it views the household as the relevant unit for analytical and policy purposes (World Bank 1986; Geier 1996: 27). The theoretical basis for this view is that entitlements to food are held at the household level. For instance, a child does not have his/her own entitlements to food, but derives them from being a member of a family. Women are often in the same situation as children: in many

[12] Maxwell and Wiebe (1998: 10) criticize the United Nations and World Bank definitions of food security for being incomplete. These definitions, they say, only regard one aspect of access to food (namely sufficiency), but they totally disregard the issues of sustainability and vulnerability. To compensate, they define a household as insecure if it "does not enjoy an acceptable likelihood that it will have sustainable access to sufficient food over a particular period of time"(ibid). This suggests that one has to consider people's sensitivity to changes in social, political, economic, and climatic conditions as well as disasters, to have an idea of their future food security. While the sustainability and vulnerability dimensions of access to food must be considered before a person can be described as food secure, these aspects will only remain an implicit part of my analysis.

developing countries women do not have the right to own land or other assets (World Bank 1986). However, this is true more generally: all entitlements are derived from an individual's position in a wider social, economic and political structure. We can still speak of an individual's entitlement, even that of a child within a household. Thus, the household level of analysis has an important shortcoming in that it does not take intra-household distribution into account. Several studies have shown that there is a sex bias in intra-household distribution of food (Sen and Sengupta 1983, Svedberg 1988).[13] By using households as the unit of analysis, researchers can still fall victim to an ecological fallacy (albeit much less than at the global or country level), as they draw conclusions about individuals on the basis of aggregate information from the household.

The entitlement approach to food insecurity guides research on causation and remedies along the lines of individuals' endowments, entitlement mappings and entitlement-sets. The strength of this approach is first and foremost that it focuses on individuals (or groups of people's) access to food, bringing us to the correct level of analysis. In addition, this approach provides us with a conceptual framework that systemizes the search for causes and remedies in the economic, social and political realms of society.

The availability approach's contribution to the study of hunger and undernutrition is important in that it focuses on constraints and "possibilities" for food production and supply. But by limiting their attention to these questions, this approach suffers a grave shortcoming. In particular, it is unable to say much about the real questions at hand: Why do victims suffer from hunger and starvation in spite of sufficient overall food availability? And, what can be done to help them? In the next section we examine what researchers within the entitlement approach have focused on in their attempt to answer these questions.

2.4 Previous Research on Entitlements to Food

Because poverty is seen as the major reason for food insecurity within the entitlement approach, it offers as many explanations for hunger as there are

[13] It is interesting to note that the bias is against girls in South East Asia, but it is the boys that are disadvantaged in Sub-Saharan Africa (Svedberg 1988).

explanations for poverty in general. Nevertheless, it is possible to divide the most common explanations into (at least) three groups (Jenkins and Scanlan 2001).

Militarism is used by one branch within the entitlement approach to explain hunger. War (both internal and external) and internal repression disrupt food production and distribution. In a study of 16 wars in developing countries in the period from 1970 to 1990, Stewart (1993) found that food production per capita fell in 13 of the countries. In three of the countries, food production fell by more than 15 percent. For the same period, Messer (1998) estimated that countries at war missed out on three percent growth in food production. Hence, even if food production per capita had not fallen during the course of the war, it could have been three percent higher if the country had been at peace. In addition, hunger is often used as a weapon in war. By cutting off people's access to food, adversaries can inflict starvation upon their opponents, and force them into submission. Furthermore, many people lose income opportunities during war, as production, transport, and markets are often dysfunctional. Finally, a high level of military spending will often reduce the funds available for government investments in food security for vulnerable groups (Cheatham 1994; Messer 1998; Pinstrup-Andersen and Pandya-Lorch 2001).

Another branch of the entitlement approach relates hunger to the aggregate level of economic development and economic growth (e.g., Smith and Haddad 2000; Jenkins and Scanlan 2001; Svedberg 2000; Haaga et al. 1985; ACC/SCN 1994). This branch's faith in economic growth is derived from an assumption that the fruits of economic growth will trickle down to the poor. Thus, Smith and Haddad's (2000) study on the causes of child malnutrition finds that growth in national income was an important determinant of food security, concluding that: "growth in national income is an extremely potent force for reducing child malnutrition." Indeed, their report estimates that about half of the reduction of child malnutrition between 1979 and 1995 came from income growth. They further found that women's education, women's status relative to men, democracy, the health environment (such as access to clean water, sanitation and health services), and national food availability were all important for explaining food security in developing countries.

However, the dominating branch of the entitlement approach disputes the effect of economic growth per se, and claims that only redistributing income and/or wealth can solve hunger. In this context, economic growth only contributes to

alleviating food insecurity insofar as it finances redistributional public policies. On the other hand, there is no guarantee that (more) affluent countries use their wealth to improve the food security of the poor (Sen 1981 and 1989; Dréze and Sen 1989; World Bank 1986; von Braun et al. 1992; Lipton 1977; Geier 1996; and FAO 2002a). Dréze and Sen (1989) argue that conventional estimates of real income (such as GDP per capita) measure aggregate wealth in the economy, but say little about people's command over food. More important than a country's level of economic development is how the wealth is distributed. However, they recognize that countries with a high aggregate level of economic development are better equipped to provide public support to underprivileged groups. To achieve such redistribution, public action, popular participation, urban bias, and improving the status of women take center stage. Thus, this branch of the entitlement approach expects democracies to have less food insecurity because elected politicians must respond to the poor masses' demand for redistribution, while autocracies do not need the support of the (poor) population to stay in power.[14] In the overall conclusion of their study, Dréze and Sen argue that public policy is central for reducing food insecurity. In this setting they emphasize the role of public participation: "It is, as we have tried to argue and illustrate, essential to see the public not merely as the "patient" whose well-being commands attention, but also as the "agent" whose actions can transform society. Taking note of that dual role is central to understanding the challenge of public action against hunger" (1989: 279).

Although this branch of the entitlement approach offers an improvement on the availability approach tradition, there is room for further progress in the study of food insecurity. In the following section I present some important criticisms of the entitlement approach, with an eye at eventually developing an approach to food insecurity that considers entitlement and availability issues concomitantly.

2.5 Shortcomings in the Literature on Entitlements to Food

Much of the debate around the entitlement approach refers to work on famines. Since the focus of this thesis is on chronic food insecurity, I mainly describe those critical

[14] However, as I discuss in Section 5.2.1, economic elites often have more influence over democratic policies than the poor masses. They will often use this power to hinder policies that can improve food security for the poor, because these policies will most likely require increased taxation of, and reduced transfers to, the elite.

voices that deal with this form of food insecurity. When I do include criticisms relating to famine, I do so because these criticisms also apply to the study of chronic food insecurity.

While embracing the general framework of the entitlement approach, Woldemeskel (1990) criticizes Sen for generally being too possession-oriented, and for overlooking the role of market forces and institutions. Woldemeskel argues "that one's ability to command food is contingent upon four determinants: (a) availability, (b) institutional elements, (c) market forces, and (d) possessions. While Sen's approach, anchored in (d), recognizes and dismisses (a), it all together ignores (b) and (c)" (Woldemeskel 1990: 491).

Let me address his second point—b) institutional elements—first. Woldemeskel does not define what he means by institutions, but Scruton (1982: 225) defines institutions as "an established law, custom, usage, practice, organization, or other element in the social life of a people; a regulative principle or convention subservient to the general needs of a community." In addition, Scruton states that institutions can be divided into three categories: the political (which is concerned with regulating the pursuit and exercise of power), the economic (concerned with maintaining production and production relations) and the cultural (involving education, culture, and leisure and the institutions of kinship, including the family). Similarly, Østerud et al. (1997: 97) claim that there is widespread agreement that institutions should be understood as rules and norms or a set of rules and norms within which actors interact (naming markets, contracts and property rights as examples of such).[15]

Defined in this way, institutions are at the center of Sen's analysis: they constitute the major link between a person's endowments and his/her entitlement-set. Institutions (such as citizenship, kinship and culture) interfere with market forces and influence the distribution of food in society. As Sen (1981: 46) puts it: "The exchange entitlement mapping, or E-mapping for short, will depend on the legal, political, economic and social characteristics of the society in question and the person's position in it. Sometimes the social conventions governing these rights can

[15] There is a separate tradition within development research that focuses on institutions and is associated with the Nobel-laureate, Douglass North (see, for example, North (1989)). While this

be very complex indeed—for example those governing the rights of migrant members of peasant families to a share of the peasant output." He also points out that social security provisions (such as unemployment benefits and employment guarantees) and taxation are also reflected in the E-mappings (Sen 1981: 46). In this light, there should be ample room for considering institutions in the entitlement approach.

Patnaik (1991: 3) also criticizes the entitlement approach for not privileging trends in food availability (per capita) as an explanation for famine. She argues that a decline in food availability played a much more central role in the Bengal famine than Sen recognizes, referring to a 30 percent decline in per capita food availability in the decades before the famine. Patnaik further argues that: "It would be a grave error to ignore or discount long-term decline in food availability for … these trends can set the stage for famine even though famine does not thereby become inevitable" (1991: 3). This shortcoming is closely related to Woldemeskel's point "a" that Sen recognizes but dismisses food availability, and his point "c" that Sen completely ignores market forces, to which we now turn.

Woldemeskel and Patnaik address important shortcomings in the way that Sen dismisses food availability and market forces. Roughly stated, market forces are those of supply and demand, which determine equilibrium quantities and prices in markets (Black 1997: 291). The entitlement approach does not, however, completely ignore these forces. On a general level, Sen suggests "concentration on such policy variables as social security, employment guarantees, terms of trade between non-food and food (especially between labor power and food)" (Sen 1980: 620). He further claims, as described in Section 2.2 above, that the Bengal Famine occurred because of inflationary pressure (expanded public expenditure and panic hoarding of rice) and increased food prices. But Sen does not focus on the important relationship between food availability and food prices, which should be central to any discussion about entitlement mappings and food security.

The level of food availability is important for entitlements to food because it influences food prices. Kalecki (1971: 43-61) explains this link in terms of the inelastic properties of food production. Because it takes time after a seed is planted

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tradition has been criticized for not discussing how power relations, and especially state power, may overrule institutions, the debate lies beyond the scope of this thesis.

before it bears fruit, food production cannot be expanded rapidly, and the supply of food will be inelastic with regard to demand. Consequently, where the level of food supply is low, relative to its demand, prices will tend to rise. On the other hand, where the supply is greater than demand, prices will tend to fall. This is unlike (the much more elastic) production of industrial goods, where supply varies according to demand and prices are relatively stable (ibid). Even if they wanted to, most developing country governments do not have the economic means to bring prices sufficiently down by market interventions (von Braun and de Haen 1983). Thus, because of the inelastic properties of food production, availability greatly affects the terms of trade between endowments and food, and thereby food insecurity.

On a trivial level, the criticism (about the disregard for food availability) may be easily refuted in the manner of Osmani (1995a). Osmani correctly claims that Sen does not dismiss food availability decline (FAD), he simply says that it is usually not the ultimate cause of famine and endemic hunger. Osmani further argues that Sen's main aim has been to prove that food availability decline should not be taken as a universal explanation for all famines. For this reason, some people have perceived his approach to imply that food availability could *never* explain famines. But the reason for de-emphasizing food availability decline (as a cause of famine) was to challenge the hegemonic position of the food availability approach. Sen's purpose was not to prove that starvation is *never* caused by food shortages, but to direct the search for causes into new areas: endowments and E-mappings.

E-mappings can capture the effect that market forces have on (indirect) entitlements to food, as it maps the relationship between a person's endowments and the amount of food he or she can get from exchanging those endowments for food. Nevertheless, despite the fact that E-mapping is a central part of the formal entitlement approach, Sen himself trivializes the role of food availability: "If one person in eight starves regularly in the world, this is seen as the result of his inability to establish entitlement to enough food; *the question of the physical availability of the food is not directly involved*" (Sen 1981: 8, my emphasis). In his unwillingness to consider both endowments and availability explanations concomitantly, I think that Sen's explanation comes up short.

However, Sen's swift handling of food availability does not mean that the entitlement approach (as an approach) is *unable* to consider both endowments and

food availability concomitantly. A few recent studies have incorporated food availability in analyses of food insecurity at the individual level. These studies meld the two approaches by studying how food availability influences people's *access* to food.

Sahn and von Braun (1989), for instance, have showed that increased variability of cereal production significantly increases food consumption variability. Furthermore, Smith and Haddad (2000) found that increased food availability had been responsible for about a quarter of the reduction in child malnutrition between 1970-95. Moreover, they found that the strength of food availability's influence depends on the initial level of food supply. Where food supplies are very low (such as in many of the Sub-Saharan countries), food availability is more important for improving food security—more than in countries where the food supply is relatively high.

On the other hand, Nubé (2001) investigated the bivariate relationship between food availability (measured as per capita daily energy supply) and the mean weight of adult women (an indicator of food security on the individual level) in 23 developing countries, and found no significant relationship (the correlation coefficient was 0.01 with a p-value of 0.96). Nubé also tested the relationship between the prevalence of underweight women and the prevalence of underweight children under five, and found a strong significant correlation (the correlation coefficient was 0.88 and the p-value was 0.001). This suggests that women's weight can be used as an indicator for food insecurity, insofar as underweight in children is a useful indicator (see Chapter 3). Although these findings rest on only bivariate correlation analyses, the results of this study indicate that food availability does not have much of an effect on food security in developing countries.

However, in their cross-country, multivariate analysis, Jenkins and Scanlan (2001) found that the food supply weakly influences the level of hunger among children under five (in developing countries). They offer two, somewhat contradictory, conclusions about the effect of the food supply on child hunger. First, they conclude that: "Food supply has a positive but small impact,[16] suggesting that critics of the "food availability" thesis who contend that food supply is irrelevant

[16] They use the prevalence of children under five with healthy weight as their dependent variable. Thus, a positive effect means that it is good for food security.

have overstated their argument" (ibid: 737). However, in their overall conclusion they state that: "Our most important finding is the relatively weak impact of food supply on child hunger rates" (ibid : 738).

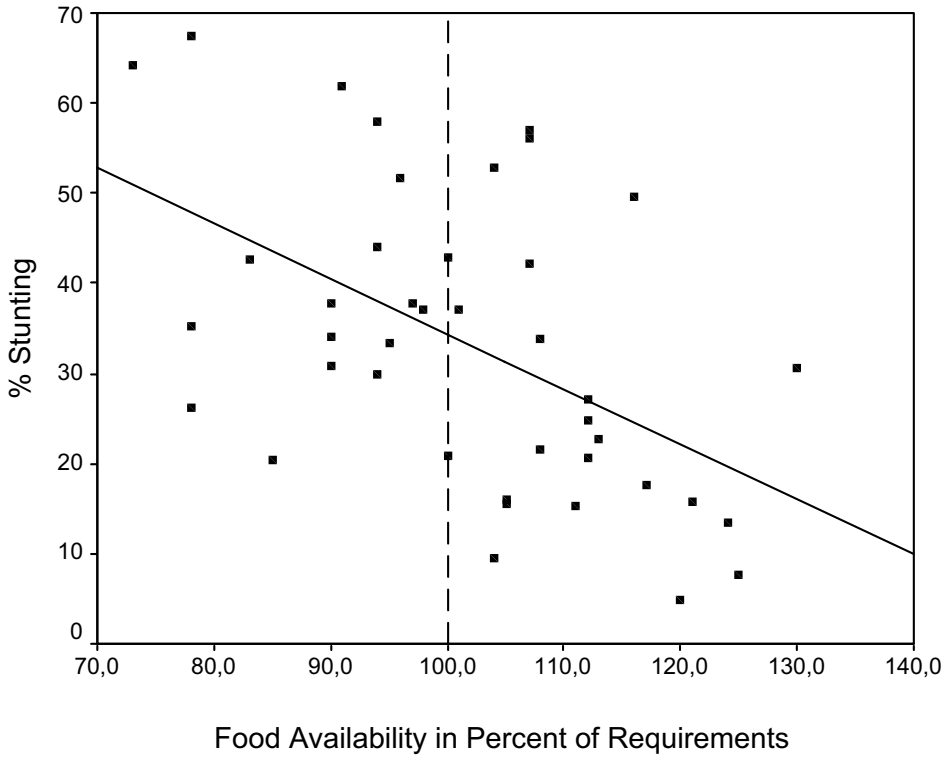
One explanation for this weak effect may be that Jenkins and Scanlan do not include a variable that can account for the income side of the entitlement mapping (E-mapping) in their analysis. While they do control for the *level* of economic development, and economic growth, these variables do not say anything about the *distribution* of income. Thus, Jenkins and Scanlan study the effect of food availability separately from people's endowments. Of course, this is no better than studying the effect of people's endowments separately from food availability (and thereby the price of food).

In a preliminary analysis of the relationship between food availability (measured as per capita dietary energy supply in percent of the average minimum requirement) and the prevalence of stunting in the 41 developing countries used in this study, I found a correlation (Pearson's r) of –0.514 (with a p-value of 0.001). This indicates that high food availability is associated with a low prevalence of stunting (in children under five). Although this is a considerably stronger correlation than was found in Nubé's (2001) analysis of the relationship between DES per capita and the mean weight of adult women (above), it nevertheless implies that the food availability ratio is an insufficient explanation for the prevalence of stunting. This insufficiency is clearly evident in Figure 2.1, where we find that some countries with a food availability ratio below 100 (which indicates an absolute food shortage) have a lower prevalence of stunting than some countries with a positive food availability ratio.

Of course, from a bivariate correlation analysis we cannot say that food availability has an independent effect on stunting. This analysis is only meant as a first step in a longer journey toward understanding the causes of food insecurity in developing countries. In order to establish whether food availability has an independent effect on food insecurity, we need a carefully specified multivariate model of food insecurity.

In spite of his defense of Sen, Osmani offers an insightful analysis of the relationship between food availability and food insecurity. In his own study of "The Food Problem in Bangladesh" (1995b) Osmani argues that the importance of food in

Figure 2.1: Food Availability Ratio and Stunting



Note: Pearson's r = -0.514, p-value = 0.001
Operationalization and sources: See Section 6.2: The Indicators.

the production structure of developing countries gives food availability great influence on the level of economic activity and, thus, the incomes and the food entitlements of the poor. Not only does food production affect the entitlements of peasants (whether they produce food for self consumption or for the market) and agricultural wage workers (that rely on participation in agricultural (food) production for their incomes), but the level of agricultural (food) production also influences the incomes of the non-agricultural population through linkages between growth in the agricultural and the industrial sectors. Thus, the influence of food availability on real income stems from the central role that food production has in the production structure of developing countries, as well as the relationship between food availability and the price of food (Osmani 1995b).

Given the division in research on food insecurity between studies that focus on food availability, and those that focus on entitlements to food, this link is mostly neglected.

2.6 Summary

This chapter has aimed to provide the larger context of debate, within which this project is embedded. Toward that end, it had three main purposes. First, this chapter aimed to describe the availability approach, and explain why it offers insufficient explanations to the study of hunger. This dearth stems mainly from the fact that it focuses on the wrong level of analysis and, therefore, overlooks the issue of distribution. The second aim to this chapter was to argue that the entitlement approach is a useful framework for studying chronic food insecurity. The entitlement approach is superior to the availability approach because it: (a) focuses on the individual level of analysis; and (b) can provide an explanation for why some people starve when others live amongst plenty. The chapter's third purpose was to argue that food availability matters for individual food security, even though the availability *approach* is insufficient. Because food availability influences food prices, it is important for *entitlements* to food. Thus, food availability needs to be integrated into the entitlement approach.

By juxtaposing and combining these two disparate approaches I aim to show the potential of an approach that builds on the strengths and insights of both. In Chapter 5, I will employ this synthesized approach to sketch a conceptual scheme of the relationship between land concentration and food insecurity.

However, before we move on to the conceptual and empirical analyses, it is important to gain some insight into the extent of the problem of food insecurity, as well as the pattern of land distribution in the developing world. In this chapter we have seen that the availability and the entitlement approaches have diverging definitions of food insecurity. From the availability perspective, food insecurity is a state of there not being enough food. A description of the extent of food insecurity from this perspective would focus on the (average) per capita food supply, compared to the people's average food needs. From the entitlement approach, on the other hand, food insecurity is a state of not having enough food. This definition demands indicators that reflect people's access to food.

There should be no doubt that this study needs an indicator of the second kind, one that reflects people's access to food. However, there is also controversy over how to measure people's access to food. For this reason, the next chapter will discuss the alternative methods, and explain why I rely on the prevalence of stunting

in children under five as my indicator for food insecurity. Only then, when I have arrived at a useful indicator for food insecurity, can I describe and explain the extent of the problem in the developing world.

3

Measuring Food Insecurity

Once we choose to define food insecurity as inadequate *access* to food, the next task is to find an indicator that captures this phenomenon. There are two comprehensive databases on access to food in the developing world: 1) the FAOSTAT database published by the United Nation's Food and Agriculture Organization (FAO 2002b); and 2) the "WHO Global Database on Child Growth and Malnutrition", from the World Health Organization (WHO 2000). Both databases try to capture the phenomenon of entitlement to food, but they do so in different ways: the FAO data measures inadequate access to food (and is called the "Food Inadequacy Approach"); the WHO data measures the *result* of inadequate access to food (and is labeled the "Anthropometric Assessment Approach") (FAO 1996: 6). Both measures have their merits and problems. The purpose of this chapter is to clarify why I use the WHO measure of the prevalence of stunting in children under five as my indicator for food insecurity.

This chapter has four sections. In Sections 3.1 and 3.2, I describe the methods used to produce the WHO's and the FAO's data, and discuss their (relative) qualities and shortcomings. In essence, the nature of my research question leads me to rely on the WHO's data. As there is some disagreement in the literature about the validity of this indicator for food insecurity, Section 3.3 explains why this is the best indicator for my study. In this section I also discuss the potential problems that may result from using the prevalence of stunting in children under five as my indicator for food insecurity. Section 3.4 summarizes.

3.1 The WHO's Method

The WHO data come from the "WHO Global Database on Child Growth and Nutrition" (WHO 2000). These data are derived from anthropometric measures of representative samples of children under five. Insofar as child malnutrition is correlated with that of the rest of the population, it serves as a proxy for food insecurity in the general population. As mentioned in Section 2.5, Nubé (2001) studied the relationship between the prevalence of underweight in children under five

(one of three WHO-indicators of malnutrition) and the prevalence of low Body Mass Index (BMI) among adult women in 23 developing countries, and found that these measures were highly correlated (with a correlation coefficient 0.88 with a p-value of 0.000). Although the sample size is small, this result indicates that the nutritional status of children under five is a useful indicator of undernutrition in the population at large. However, it is important to keep in mind that the data draws from children under five, and not the whole population.

An accurate anthropometric assessment of the number of undernourished people in an area requires that the whole population be examined. But investigating the nutritional status of every person in the world, a region, or—for that matter—a country, is impossible. Time and money constraints simply forbid such a detailed census (Foster 1992: 31-2; FAO 1992). In its place are second-best studies, based on sampling techniques.

The WHO's database uses measures for underweight, stunting, and wasting in children under five. This age group is used because growth patterns of well-fed, healthy preschool children from diverse ethnic backgrounds are very similar (WHO 2000: 5). *Stunting* means low height-for-age, and reflects chronic undernutrition. *Wasting* is low-weight-for-height, and indicates in most cases a recent and severe process of weight loss. *Underweight* means low weight-for age, and reflects low body mass (relative to chronological age). This last measure is influenced by both the child's height and weight. For this reason, the measure is a bit complicated to interpret because it fails to distinguish between tall, thin children and short children with adequate bodyweight. As a result, the measure cannot help us to determine whether malnutrition has been chronic or transitory (WHO 2000: 4).

These measures are compared against a reference population: the American population of children under the age of five. This reference population has been used since 1970, when a wide survey of these measures on American children was completed (WHO 2000: 5-6). Scholars consider this a reliable reference because, as I mentioned above, there is very little cross-ethnic variations in this measure for well-fed, healthy preschool children (WHO 2000: 5-6). Studies have shown that children of socio-economically advantaged classes in developing countries follow the growth reference curves of healthy, well-nourished children in developed countries. Similarly, children of the same genetic background show widely differing growth

performance depending on the environment in which they live. As a result, the dominant opinion today is that people of all races have the same growth potential, even though this growth potential may not be attained in one generation. Consequently, country-, or race-specific growth references are not appropriate. Nevertheless, the reference standard has recently been challenged, and the WHO is currently reconsidering its applicability (WHO 2000: 5-6).

There is disagreement about the threshold, under which a person should be classified as undernourished. Osmani (1992: 2-5) categorizes this disagreement in terms of a conflict between two groups. On the one hand, so-called 'conventionalists' argue that all people who are suffering from any degree of nutritional deficiency should be counted among the undernourished. On the other hand, 'adaptionists' argue that such an ideal state is unattainable, and that the human body adapts itself in a number of ways to minimize the consequences of nutritional constraints. Adherents of this 'theory of adaptation' suggest that many standard bodily functions may perform at a satisfactory level, even when standard nutritional requirements are not met. As a result, they suggest that the only practical measure of the magnitude of nutritional deficiencies is one aimed at very serious conditions: conditions so serious that they pose a threat to life.

In the WHO, a child is considered undernourished if his or her measure falls below two standard deviations from the norm. This reflects the WHO's conventional position in the debate about what constitutes hunger: the child is counted as undernourished even if he or she is not dying. The reason for counting these children is that such a degree of undernutrition is a hindrance for the child's well being, and poses a long-term threat to his/her life.

The anthropometric data are gathered from different sources such as government health statistics, survey reports from international and non-governmental organizations, and articles published in the scientific press. All of the surveys that are included in the database are subject to specific standards with regard to sampling, measurement techniques, and presentation (WHO 2000: 10).[1]

[1] For a few countries, where such standardized information is unavailable, other—less reliable—information is provided. Wherever this is the case, it is stated in the notes to the data, and they are not considered part of the database (WHO 2000: 10).

Unfortunately, nationally representative (and comparable) surveys of this kind are costly and time consuming. In addition, these measures used by the WHO incorporate an element of disease, as unfulfilled growth potential can result from both inadequate food intake and disease. (I will discuss this further in Section 3.3). These are two of the reasons why the FAO has chosen a different way of assessing and measuring the problem of food insecurity. We will now examine this approach.

3.2 The FAO's Method

The FAO's data on undernourishment are derived by the 'food adequacy approach' outlined above, and contain estimates of the number of people whose *food intake,* measured in caloric intake, is insufficient for meeting their basic energy requirements (FAO 1999: 6). This measure is calculated by combining information on the amount of food available to a population and how this food is distributed among individuals in that population.

The FAO also resides within the conventionalist camp with regard to when a person should be considered food insecure (undernourished). This is reflected in the reference standard that they use for how many calories are regarded as a minimum requirement, which is set by the method recommended by the FAO/WHO/UNU's "Expert Consultation on Energy and Protein Requirements". This reference standard reflects 'the average calories (kcals) needed per day to maintain body weight and support light activity' (FAO 1992: 7). This standard implies that an undernourished person cannot obtain enough calories to maintain the weight that is appropriate for his (or her) height, sex and age. The reference to light activity varies for children and adults. For children, light activity means the level that is normal for children in affluent societies. For adults, light activity implies the minimal activity required for productive work (Alexandratos 1995: 50; FAO 1992: 7-8, 12). Therefore, the average minimum requirement varies across countries according to the different age and sex composition of the populations.

Traditionally, the most common method for measuring the prevalence of food insecurity in the developing world has been in terms of the balance between the number of people in a country or region, and the amount of food available for human consumption in that area. These estimates were usually derived by the "Food Balance Sheet" (FBS) approach. The FBS approach begins by taking the aggregate food

stocks from food balance sheets at the beginning of the year. It then adds to them the amount of food produced and imported, while subtracting from this the amount of food exported, used as livestock feed and seed, and the food stocks remaining at the end of the year. By converting the estimated food available for human consumption of each commodity into kilocalories (kcals), and dividing these by the number of people in the area, it is possible to calculate per capita food supply figures for these balance sheets. The average supply of kcals per capita is then compared to the average minimum requirement of those people (Foster 1992: 3, 31-2).

This method reflects the availability approach's view of food insecurity. The problem with this aggregate method of measuring undernutrition is that the test is performed at aggregate levels, while the conclusions refer to individuals. From these aggregate measures, one cannot conclude whether all people get enough food at all times. As I discussed in the Chapter 2, having enough food in the area is a necessary—but not sufficient—criterion for individual food security. The food in a given area might be distributed in ways that leave some people with less, while others get more, than their minimum requirement. As a result, this aggregate method of measuring under nutrition can only be used to identify countries or regions where undernourishment rates are *expected* to be high.

For this reason, the FAO has developed a better method that takes the data on average per capita food supplies in given countries (derived by the food balance sheet approach) and combines them with information on the *expected distribution of the food* within these countries. In this way they try to work around the ecological fallacy of drawing conclusions about individuals on the basis of aggregate data.

Thus, the FAO estimates the prevalence of undernutrition on the basis on the following factors: 1) the age and sex composition of the population, which decides the average minimum calorie requirement; 2) the average per capita food supply in the country, derived by the FBS approach;[2] and 3) how this food supply is assumed to be distributed among individuals in that country.[3]

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[2] The accuracy of these data has been questioned because the underlying data needs are so enormous, and precise values are often missing for at least some of the inputs. Where input is missing, the blanks are filled in with estimates based on approximations and informed guesswork. The data should therefore be interpreted with caution (FAO 1996; Alamgir and Arora 1991; Millman and de Rose 1998: 22). There are, however, no better cross-country data on food supply available.

[3] The method is described in detail in FAO (1996, Appendix 3).

The distribution of food within countries is based on information about the amount of food to which individuals—within representative samples of the population—have access. (The FAO has found that most people in developing countries have access to less than the country's average per capita food supply, while considerably fewer people have access to more than this amount.) The sources of information, from which the distribution is estimated, vary from country to country. Some countries have household-level data on energy intake, food expenditure and total income and expenditure, from which it can be calculated directly. Other countries have only some of these data, while for still other countries no such data exist. For countries in the latter two categories, the FAO uses data on the general distribution of income and wealth, of which land concentration is a major determinant. However, the accuracy of these estimations is necessarily lower when they are based on more indirect information (FAO 1996: 134-35). When estimating the prevalence of undernutrition in a specific country, the per capita food supply and the distribution of food are combined to construct the distribution curve of the country's food supply. From this curve one can derive the percentage of the population whose food intake falls below the average minimum requirement (FAO 1999). In these calculations it is assumed that the distribution of food varies so little over time that it does not have to be computed anew for each point in time that the data on undernourishment are estimated.

This method is designed to estimate the proportion and/or the number of undernourished persons, but it cannot identify who the undernourished are. Thus, it cannot be relied upon for targeting interventions that benefit undernourished people. Furthermore, the FAO does not have information on changes in the distribution of food (over time). Since the food supply is the only variable (in this indicator) that the FAO measures over time, changes in undernourishment simply reflect changes in per capita food supply over time (Svedberg 2000: x). Therefore, these data cannot be used to monitor the effects of redistributional polices.

3.3 Consequences of Using the Prevalence of Stunting to Measure Food Insecurity

Since the data on undernourishment (food intake) are estimated on the basis of food availability[4] and its distribution, and for many countries the information about this distribution is based on information about the distribution of access to land, I cannot use these data for studying the effects of land concentration and food availability on food insecurity. The relationship between food availability and undernourishment is tautological; when food availability increases, food insecurity is reduced. The relationship between land concentration and undernourishment is determined by the extent that the estimation of the coefficient of variation (CV) is based on the distribution of landholdings. Because I cannot use the FAO's data on undernourishment, I will have to use the WHO's data on child malnutrition. What, if any, consequences will this have for my analysis?

The FAO's data on undernourishment and the WHO's data on malnutrition measure two different things. The FAO's data measure access to food, compared to requirements (for a healthy and productive life). The WHO's data measure the nutritional status of children under five, which reflects the outcome of both food intake *and disease*. Nubé (2001: 1279) has tested the correlation between the prevalence of inadequate access to food (measured in terms of the FAO's data on undernourishment) and undernutrition (measured in terms of the WHO's data on the prevalence of underweight in children under five) in 23 developing countries,[5] and finds a correlation coefficient of only 0.26 (with a corresponding p-value of 0.24). When I performed a similar test and correlate the prevalence of stunting in children under five (as estimated by the WHO) and the prevalence of undernourishment (as estimated by the FAO) in 84 developing countries around 1995, I get a correlation coefficient (Pearson's r) of 0.56 (with a p-value of 0.000).[6] Although the correlation is better in this sample than in Nubé's, it remains low in this context.[7]

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[4] Food availability is operationalized as daily per capita dietary energy supply (DES), which is the same operationalization I use in the computation of the Food Availability Ratio in my analysis (see Section 6.2).

[5] The data on both indicators are from the years 1990 to 1997.

[6] The source of the WHO's data is De Onis et al. (2000), and the source of the FAO's data is FAO (2002b).

Nubé asserts that there are two possible reasons for the low correlation. First, Nubé discusses the possibility that the poor correlation can be explained by different levels of disease or physical activity between countries with the same level of food consumption. The conclusion is that: "available information suggests that such factors are unlikely to play a major role in explaining these findings" (Nubé 2001). Nubé claims that the primary reason for the incoherence between the two indicators is the poor quality of the FAO's data on undernourishment. Because the estimation procedures are so complex, "data on prevalence rates of food energy inadequacy are likely to be subject to wide margins of error. On the other hand, available anthropometric data are likely to be less subject to biases or errors, mainly as a result of the fact that the collection of anthropometric data is a relatively straightforward procedure" (Nubé 2001).

It is generally accepted that malnutrition (among children) is a result of too little (and/or wrong) food *and* disease (Pinstrup-Andersen 1995: 2). However, it is also acknowledged that a child's dietary intake affects his or her health status (e.g., low dietary intake leads to a weakened immune system), and that health status affects the dietary intake (e.g., the child loses his or her appetite when sick and the dietary intake will be low, and/or the child cannot utilize all the nutrients if it has diarrhea) (UNICEF 1990, 1998; Jonsson 1993; Engle et al. 1999; Smith and Haddad 2000; DeRose and Millman 1998: 8). How problematic is it, then, to use the nutritional status of children, or more precisely the prevalence of stunting, as an indicator of access to food? The most important question in this regard is: How much of the prevalence of stunting in children under five is a result of food insecurity, and how much can be explained by disease?

Osmani (1995b: 335) argues that: "the prevalence of stunting…[in Bangladesh…] persists among three-quarters of the population due to the cumulative effects of long-term nutritional deprivation". Like others, Osmani argues that diseases related to health conditions (such as sanitation and the quality of drinking water) influence malnutrition in developing countries, but that: "it is also true that lack of food accentuates the effects of such disease-induced malnutrition. As a result,

[7] I have discussed the problem with the low correlation between these two measurements of food insecurity in Brigham (2003b).

those with a poorer entitlement to food are more vulnerable to physical malnutrition" (ibid).

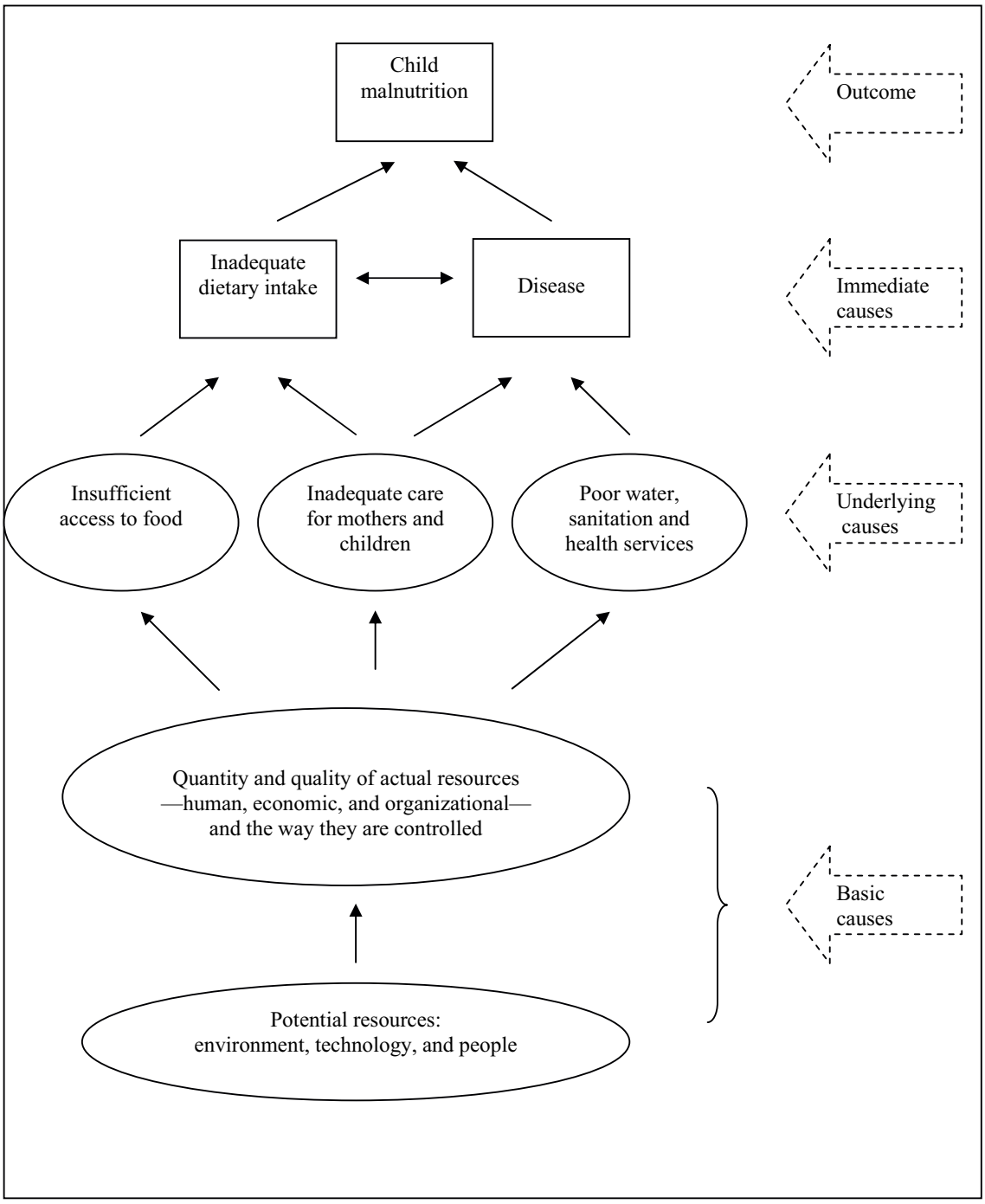
Svedberg (2000: 203) argues that: "most studies of disease as a cause of inadequate growth are beset with problems. The incidence of disease is known to correlate strongly with poor sanitation and a variety of socio-economic variables that also affect child growth and weight, which have seldom been controlled for". Tomkins and Watson (1989) reviewed the literature on malnutrition as a cause of impaired immune response. They found evidence that lack of food weakens the immune system. Thus, according to this study, a lack of food leads to a higher propensity for disease. Per Pinstrup-Andersen and Pandya-Lorch (2001) argue that children who are undernourished "are more likely to have impaired immune systems, poorer cognitive development, lower productivity as adults, and greater susceptibility to diet-related chronic diseases such as hypertension and coronary heart disease later in life."

It is therefore probable that poor children in developing countries come down with diseases (more often than other children) because their immune system is weakened from prolonged lack of nutrients. In addition, it is probable that most diseases would not result in stunting if the child had access to adequate food before, during and after the illness. Thus, while stunting results from inadequate access to food and disease, it can be argued that inadequate access to food is the most important determinant.[8]

In the field of nutrition studies it is argued that a child's food intake is determined by access to food and the care environment. This literature also claims that disease (among children) is determined by the care environment and access to basic health services. Finally, we have seen that it is recognized that food intake influences disease, and that disease influences food intake. This recursive relationship between food intake, disease, and children's nutritional status is illustrated in Figure 3.1.

[8] AIDS will most probably affect the nutritional status of children that are infected, and of children whose parents are infected and become unable to provide for their families. Besides, it could be argued that the prevalence of AIDS is higher among the poor and uneducated, and thus has some of the same basic causes as stunting. However, the AIDS epidemic had barely started in the mid 1908s (which is the period under study). Since the years covered by this study are mainly before the onset of the AIDS pandemic, the disease cannot be an important cause of the prevalence of stunting. Thus, I will not speculate further into this issue.

Figure 3.1: Causes of Child Malnutrition



Source: Adapted from UNICEF (1998), Smith and Haddad (2000) and Jonsson (1993)

From Figure 3.1 we can see that the immediate causes of child malnutrition are inadequate dietary intake and disease, and the interplay between these two factors. The underlying causes for inadequate dietary intake are insufficient access to

food, and inadequate care for mothers and children. Thus, a child can have inadequate dietary intake even though he or she has access to enough food, if he or she does not receive proper care. Care in this connection means that the responsible persons are able to understand and fulfill the nutritional and health related needs of the child. Making sure that children are immunized (if possible) is mentioned as an important aspect of such care (UNICEF 1998). The underlying causes for disease are also inadequate care for mothers and children (as they were for food insecurity), as well as poor water, sanitation and health services.

Turning to the basic causes in Figure 3.1, we find that insufficient access to food, inadequate care for mothers and children, as well as poor water, sanitation and health services have their roots in the quantity and quality of the actual human, economic, and organizational resources (in the country), and the way they are controlled. Again, these are a result of the potential resources of environment, technology and people. Among the "upper level" basic causes we find factors associated with different branches of the entitlement approach: e.g., public policy, participation, regime type, war, and the level of economic development (as well as hereto understudied factors). It is at this level that we find (the organizational aspect of) land distribution, as well as food availability and agricultural productivity (and the interplay between them). The most basic of the basic causes is the interrelationship between the amount of natural resources, the number of people that depend on them, and the technology that can transform potential resources into actual resources. These are factors associated with the availability approach. From this figure we see that the basic influences on child malnutrition depend on political, cultural, religious, economic, and social systems (i.e., the focus of the entitlement approach).

To amend for the fact that disease is a (minor) cause of stunting, I could control for the incidence of disease (in children under five). However, there are no comparable data that cover enough of the countries in this study. Therefore, I will include variables that previous research (e.g., UNICEF 1998 and Smith and Haddad 2000) has found to have an effect on the prevalence of disease. For this purpose I will include child immunization rates and the percent of the population that has access to improved water source and sanitation facilities. By including these control variables in the multivariate regression analyses of the causes of food insecurity, I

can possibly isolate the effects that the other variables—that are on a lower causal level in Figure 3.1—have on the access to food.

In conclusion, there is no consensus in the literature about the greater reliability of the one (WHO) or the other (FAO) dataset, as an indictor for food insecurity. Since there is no consensus, it is up to the individual researcher to choose the indicator he or she believes is best suited for the particular study. As explained above, the nature of my research question compels me to use the WHO's data on malnutrition in children under five. Following Foster (1992: 36-40), Osmani (1995b: 335), and Nubé (2001), among others, this should not be controversial or problematic.

3.4 Summary

In this chapter we have seen that the FAO's data on undernourishment is an indicator of inadequate access to food, while the WHO's data on stunting is an indicator for the result of inadequate access to food and disease. I will use the WHO's indicator on the prevalence of stunting in children under five because land concentration is an internal component of the FAO's data. In their stead, the WHO data can serve as a proxy for food insecurity. In using this proxy, we need to keep in mind that the data only say something about the nutritional situation of children less than five years of age. In addition, I will control for variables that are associated with the prevalence of disease, to (try to) separate the effects that the other variables in the model have on the access to food.

In the previous chapter I defined food insecurity as inadequate access—or, in other words, inadequate entitlements—to food. This chapter has provided us with an indicator of food insecurity that can be used in an analysis of its relationship with land concentration and food availability. Hence, we are now ready to examine the trends in food insecurity and land concentration. This is the purpose of the following chapter.

4

The State of Food Insecurity and Land Concentration in the Developing World

I have now explained why I consider the concept of food insecurity in terms of entitlements to food (in Chapter 2). I have also argued that the prevalence of stunting in children under five is the best indicator for inadequate entitlements to food, at least for the purpose of this study (in Chapter 3). Now that I have defined the meaning of food insecurity, and resolved the question of how to measure it, I can turn to an empirical description of the problem at hand. Thus, this chapter provides an account of the state of food insecurity and land concentration in the developing world. Towards that purpose, it has three sections. The first section discusses the prevalence of food insecurity in the developing world today, with reference to historical trends and future projections. In the second section, I define the concepts of land concentration and reform, and describe patterns in land concentration across the developing world. In Chapter 5 we will see that the availability of land (per capita), as well as land and labor productivity in agriculture, influence food insecurity. For this reason I also use this section to provide background information on these conditions. I summarize the chapter in the third section.

The descriptions are focused on the regional level. There are two reasons for prioritizing this level of aggregation. First, trends and structures tend to vary more across these regions than within them. My second reason is parsimony: a focus on individual countries would be too complicated and unwieldy. Besides, the data are, for the most part, readily available in the regional aggregates used herein.[1]

One final caveat: I have not been able to locate data for the various indicators aggregated in the same regional categories.[2] For this reason, I will not

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[1] There is also variation in the variables described in this chapter within the regions. These variations in the prevalence of stunting, land concentration, arable land per worker, as well as agricultural land and labor productivity will be discussed in Chapters 6 and 7, as we study the independent variables' bivariate relationship with food insecurity and/or land concentration.

[2] In particular, cross-temporal data on the prevalence of stunting in children under the age of five are not available in the same regional aggregates as the other indicators in this chapter.

be able to compare the levels and developments of food security, food supply and the various aspects of the agrarian structure within developing regions. A cross-regional comparison, one aspect at a time, will have to suffice, until we turn to the cross-country analysis of the relationships in Chapters 6 and 7.

4.1 The State of Food Insecurity

The purpose of this chapter is to get an overview of the magnitude of the problem that will be analyzed. For this reason, I will focus the description on the same indicator for food insecurity as used in the empirical analysis in Chapter 6 (i.e., the WHO's stunting indicator). In addition, I will provide a brief sketch of the (alternative) FAO's data on undernourishment, in order to swiftly compare the pictures painted by these different indicators. I will first describe trends, from 1980 to those projected for 2005, for stunting in children under the age of five across: 1) Asia, 2) Africa, and 3) Latin America and the Caribbean. I will then briefly discuss the food supply situation across the five developing regions (South Asia; East and South East Africa; Near East and North Africa; Sub-Saharan Africa; and Latin America and the Caribbean) as well as the developing world as a whole, and compare these regions to the average for the industrialized countries. Since the FAO's data on the prevalence food insecurity are based on these measures of food supply, the discussion of these data follows.

The dimensions of the food insecurity problem are enormous. As shown in Table 4.1, in the year 2000, there were more than 180 million stunted children under the age of five in the developing countries. This represents approximately 32 percent of the population of children under five. In other words, one out of every three children below five in the developing world suffered from malnutrition.[3] Still, progress has been made. Over the two decades between 1980 and 2000, the number of stunted children decreased by 40 million (or 18 percent). Most of this reduction occurred between 1990 and 2000. The projected numbers for 2005, 164.7 million (or 29 percent of the children under five), shows that further reductions are expected.

[3] Malnutrition can mean both undernourishment and obesity. In this thesis, the term malnutrition means undernourishment, if not otherwise stated.

Table 4.1: The Prevalence of Stunting in the Developing World, 1980-2005

	Prevalence of Stunting							
	Percent of Children under Five				*Number of Children (millions)*			
	1980	1990	2000	2005*	1980	1990	2000	2005*
All Developing Countries	47.1	39.8	32.5	29.0	221.3	219.7	181.9	164.7
Asia	52.2	43.3	34.4	29.9	173.4	167.7	127.8	110.2
Africa	40.5	37.8	35.2	33.8	34.8	41.7	47.3	49.4
Lat. America & Caribbean	25.6	19.1	12.6	9.3	13.2	10.4	6.8	5.1

Note: * = projections.
Source: De Onis et al. (2000: 1226-7)

When we look at the regional disaggregates in Table 4.1, we see that most of the malnourished children can be found in Asia. In the year 2000, there were as many as 127.8 million stunted children under five in this region, while there were 47.3 million in Africa and 6.8 million in Latin America and the Caribbean. However, measured in terms of the percent of the population of children under five, Africa fares worst. In Africa as a whole, 35.2 percent of the children under five were stunted, Asia followed closely behind with 34.4 percent, while Latin America and the Caribbean fared much better with 12.6 percent. Looking into the near future, Africa is the only region where an increase in the absolute number of stunted is expected. For the other regions (as well as the developing world as a whole) a reduction is anticipated. If we look back to 1980 and 1990, we see that Asia had a higher prevalence of stunting (in %) than Africa. It is also interesting to note that Africa, at these times, had a lower prevalence of stunting than the average for all developing countries.

In addition to the disparities across regions, there is also considerable sub-regional variation. To begin with Africa: in the year 2000, the prevalence of stunting varied between 20.2 percent in Northern Africa, 34.9 percent in Western Africa, and 48.1 percent in Eastern Africa. The predicted increase in the number of stunted children under five in Africa (about 2 million by the year 2005) is expected to take place mostly in Eastern Africa, less in Western Africa, while the number of stunted is predicted to decline (by 0.5 million) in Northern Africa. There is also variation among the sub-regions in Asia, where the prevalence of stunting is 43.7 percent in South-Central Asia, compared to 32.8 percent in South-Eastern Asia. In Latin America and the Caribbean, the prevalence varies from 24

percent in Central America, to 16.3 percent in the Caribbean, and down to 9.3 percent in South America (De Onis et al. 2000: 1226).

Table 4.2 lists the ten countries with the highest prevalence in stunting (according to the latest estimates after 1990). These countries have prevalences of stunting ranging from about 45 to 55 percent of children under the age of five. Bangladesh has the highest stunting prevalence of all countries (where there are data) with 54.6 percent, India follows with 51.8 percent, and Guatemala is ranked third with 49.7 percent.[4] We can see that the three worst countries are situated outside of Africa, which is the region with the highest average, and only five of the countries on the list are in Africa. Guatemala is the only country on the list from the Latin America and the Caribbean region (although Honduras also had a prevalence of stunting as high as 38.9 percent in 1996). In addition to the ten countries shown in Table 4.2, seven additional countries have a prevalence of stunting over 40 percent. These countries are Lesotho (44.0), Mauritania (44.0), the United Republic of Tanzania (43.4), Zambia (42.4), Niger (41.1), Yemen (42.4) and Bhutan (40.0).[5] Of these states, five are in Africa.

Table 4.2: Top Ten Developing Countries in Terms of the Prevalence of Stunting

Country	Stunting, % of Children < 5	Year of Survey
Bangladesh	54.6	1996-97
India	51.8	1992-93
Guatemala	49.7	1995
Rwanda	48.7	1992
Mali	48.6	1996
Nepal	48.4	1996
Madagascar	48.3	1997
Malawi	48.3	1995
Lao. People's Democratic Republic	47.3	1994
Myanmar	44.6	1994

Source: India: WHO (2000); all other countries: De Onis et al. (2000: 1228-9)

Sommerfelt and Stewart (1994) have studied the distribution of food insecurity between rural and urban areas within 19 developing countries from

[4] The prevalence of stunting may be even higher in Ethiopia, as data on rural stunting from 1992 show a prevalence of 64.2 percent. Since stunting generally is higher in rural areas (Sommerfelt and Stewart 1994: 26) it is uncertain whether the prevalence for the whole country is higher than the 54.6 percent in Bangladesh.

[5] The years of these surveys are all between 1996 and 1998.

Asia, Africa, and Latin America and the Caribbean. They found stunting to be considerably higher in rural areas, in all but one country (Trinidad and Tobago, where stunting is at the exceptionally low level of 4.8 percent in both rural and urban areas). The median level of stunting in urban areas was 21 percent, while the median in rural areas was 31 percent. Despite the fact that the problem is worst in rural areas, there can be little doubt that there is a serious problem of food insecurity in urban areas as well.

In Chapter 2, I argued that food availability influences food insecurity. Although we have yet to discuss the causes of food insecurity, it is useful to get an overall picture of the food supply in the developing world at this point. In studying the actual supply (per capita) in the developing regions, it is important to keep in mind that a person in developing countries needs (on average) more than 1,700-1,900 kilo calories (kcals) per day (FAO 1996: 61).[6]

We can see from Table 4.3 that there was a considerable smaller food supply in all the developing regions, compared to that in the industrialized world. Furthermore, we can see that the per capita food supply has increased over the period covered in all regions except Sub-Saharan Africa. The latter region has experienced a decline in per capita food supply from 2,140 to 2,040 kilocalories, per person, per day. Thus, Sub-Saharan Africa was the region with the lowest food supply around 1990.

Table 4.3: Per Capita Food Supply by Region, 1969/71 – 1990/92

Region	Per caput DES (Kcal/day)			Average Annual Rate of Increase	
	1969-71	*1979-81*	*1990-92*	*1969-71 to 1979-81*	*1979-81 to 1990-92*
Industrialized countries	3,120	3,220	3,410	0.3	0.5
Developing countries	2,140	2,330	2,520	0.9	0.7
Latin America & Caribbean	2,510	2,720	2,740	0.8	0.0
Sub-Saharan Africa	2,140	2,080	2,040	-0.3	-0.2
Near East and North Africa	2,380	2,850	2,960	1.8	0.3
East and South East Africa	2,060	2,370	2,680	1.4	1.1
South Asia	2,060	2,070	2,290	0.0	0.9

Source: FAO (1996: 11)

Even though per capita food supply declined, the total food supply in Sub-Saharan Africa increased by 2.6 percent between 1969/71 and 1979/81, and by

[6]In addition to getting enough calories, it is also important to get enough proteins, fats, micronutrients, etc. This is not reflected in these measures of food supply.

2.9 percent between 1979/81 and 1990/92. When the per capita food supply nonetheless decreased, it is a consequence of an even faster growth in population over the same periods. All regions have experienced population growth in this period, but it is only in Sub-Saharan Africa that population growth has outpaced the growth in food supply (FAO 1996: 13).

In Chapter 3 I described how the FAO estimates the prevalence of food insecurity on the basis of the per capita food supply and information (of varying quality) about its distribution within the population. These data on undernourishment (try to) mirror people's access to food (and not the result of inadequate access as the data on stunting try to reflect); they paint a picture of the prevalence of food insecurity in the total population (not only children under five). In Chapter 3 we also learned that there is a weak correlation between the prevalence of stunting in children under five and the prevalence of undernourishment, and that the weak correlation is most probably a result of unreliable estimates of undernourishment. (Recall that this was the conclusion in Nubé 2001). In this light, it is somewhat problematic to include a description of the status and trends in undernourishment parallel to the above discussion on the prevalence of stunting. On the other hand, since these data are very often used to describe the state of food insecurity in the developing world, I will briefly introduce the FAO estimates of undernourishment.

These estimates (from FAO 2002a) show that there were approximately 799 million people in the developing world that were chronically undernourished in the year 2000. This represents approximately 17 percent of the population (at the time). Of the 799 million undernourished, as many as 508 million (or 16 percent of the population) could be found in Asia and the Pacific (India alone accounts for 233 million, and China for 119 million), 196 million (or 33 percent of the population) were in Sub-Saharan Africa, 55 million (or 11 percent of the population) in Latin America and the Caribbean, and 40 million (or 10 percent of the population) in the Near East and North Africa. This indicator also shows that the overall trend in the developing countries has been positive. In 1970 there were about 940 million undernourished people in the developing world, constituting 36 percent of the population. By 1980, the respective numbers had fallen to 843 million and 26 percent. Thus, from 1970 to 1980 there was a reduction of ten

percentage points, or approximately 100 million fewer people were undernourished. Subsequently, the rate of decrease has slowed, as the reduction in the number of undernourished from 1990 to 2000 was only 20 million, or 3 percentage points.

When we compare the 17 percent undernourished in the developing world as a whole (as estimated by the FAO), with the 32.5 percent of children under five that were stunted (as estimated by the WHO) in the year 2000, we see that the two indicators give very different pictures of the state of food insecurity.[7] It is beyond the scope of this thesis to speculate further about the reasons for this discrepancy. Since I cannot use the FAO's data in my empirical analysis, because (as discussed in Chapter 3) the FAO relies on information about the distribution of land to estimate them, I will now leave this indicator behind, and use only the prevalence of stunting as the indicator for food insecurity.

In this section we have seen that the state of food insecurity in the developing world is both dismal and grave. Although some progress has been made over the past decades, there is still an enormous problem of food insecurity across this part of the world. We have further seen that although most of the food insecure people live in rural areas, the problem is also serious in urban areas. The food supply situation across the developing world is also quite grim, but is improving in all regions except Sub-Saharan Africa, where it is deteriorating. Lastly, we looked at the FAO's indicator for food insecurity in the total population. These data also paint a dismal picture of the state of food insecurity in the developing world. However, they are highly inconsistent with the stunting indicator for food insecurity (and will not be referred to hereafter).

The above discussion has provided a glimpse into the situation of food insecurity in the developing world. We will now turn our attention to the description of what I expect is a basic cause of this food insecurity, namely the pattern of land concentration, and other related aspects of the agrarian structure.

[7] In Brigham (2003b), I have documented these differences more closely.

4.2 The State of Land Concentration

Before I begin a description of the past and present situation regarding land concentration, it will be useful to explain how I intend to use central concepts related to land concentration and land reform.

In this thesis, land concentration means the distribution of agricultural land*holdings* in a country. A landholding is "all land that is held by a household or a person, whether it is owned, leased, or held on some other basis" (Bruce 1998b: 5). Thus, land concentration is not confined to the distribution of outright ownership of agricultural land; it also concerns the degree to which use-rights to land are distributed in other forms of arrangements. Since it is commonplace in many developing countries to hold land in some form of tenancy, I have chosen to focus on the concentration of landholdings, and not ownership. A weakness with this definition is that the rights to cultivate land do not always coincide with the rights to its produce. Tenants pay a (sometimes very large) part of their output in rent, and I do not have access to data (on enough countries) to control for this. However, the distribution of landholdings arguably provides a better picture of the poor's access to land than the distribution of land ownership. In addition, it is possible to find data on the size distribution of landholdings for many more countries than is the case for the distribution of land ownership. Finally, it is important to note that I use land distribution and land concentration interchangeably in this thesis.

Land tenure is closely related to the concept of land concentration (as defined in this thesis). Barraclough (1973: 33) defines land tenure as "power with respect to land (and water)." Thiesenhusen (1995: 6) offers a more detailed definition, where land tenure means legal, traditional, or customary ways of holding land, and includes outright ownership, cash rental, sharecropping, usufruct rights, as well as common property with open or restricted access. As such, land tenure is a concept that captures the distribution of rights to cultivate agricultural land. Tenancy refers to a situation where land is leased, and those that work the land do not own it.[8]

[8] The concept of agrarian structure encompasses both the distribution of ownership and other tenure rights to land, as well as access to credit, irrigation, modern technology, infrastructure, and other variables that influence agricultural production.

According to Thiesenhusen (1995: 6), land reform means any fundamental alteration of the existing land tenure. This is usually understood to mean the redistribution of tenure rights from elite landowners to peasants without land, or with insecure access to it. Barraclough (1973: 33) defines land reform as a large-scale redistribution of power with respect to land (and water) for the benefit of small farmers and agricultural laborers. Land reforms come in many shapes and styles. They differ with regard to who gives up what and how much, and who benefits in which way. Land can be redistributed from larger farms (over a certain size) to smaller, private holdings, or into cooperatives or state-owned farms. Tenancy contracts can be considerably improved in the eyes of the leaser, and land can be given or sold to the tillers. Land reform can mean the privatization of land held under customary tenure, settlement schemes where families are settled on newly developed land and/or government-owned land, and/or government-owned land that is allocated to the poor for cultivation and/or grazing (Jazairy et al. 1992: 106). While a few land reforms have redistributed all agricultural land, most redistribute only a certain amount. Indeed, most land reforms are less extensive than originally intended, because of resistance to, or impracticalities in, the implementation process.

When I, in the following section, briefly refer to historical land reforms in the developing world, the concept of land reform has the wide meaning as described above. Thus, land reform will be understood as the redistribution of outright ownership to land (from the land-rich to the landless or land-poor), as well as improvements in access to land and/or its output (in the eyes of the peasant) through changes in other tenure arrangements.[9] However, when I—in the

[9] Agrarian reform is a broader concept than land reform. Barraclough (1973: 33) defines it as a combination of agricultural development (the application of technology and capital to increase farm productivity), colonization (the opening up of non-agricultural lands for agricultural production), and land reform (as described above). A more fruitful demarcation of the concept is found in Thiesenhusen (1995: 12), where agrarian reform "includes both redistributing land and assisting new landowners by assuring them inputs and markets, extending credit, and imparting certain technology that will help them to become agricultural producers." Thiesenhusen further explains that in bipolar agrarian structures (where a rich elite owns most of the land and most peasants are landless or nearly landless and very poor) most government policy benefits the large, capitalist farmers. Thus, the point of agrarian reform is to send more benefits to a wider group of farmers, including at least some of the poor. Parsons (1984: 19-24) defines agrarian reforms as programs designed to modify the institutional order in agriculture to change how the economic system (of agriculture) relates to the social and political structure of the society. He argues that the interrelation between abilities and opportunities is fundamental for development. Therefore, land reform—which gives people an opportunity to escape poverty—is inadequate in order to change

concluding chapter (Chapter 8)—discuss what the results of this thesis imply about the potential that land reform has to reduce food insecurity, land reform will have the narrow meaning of a redistribution of land*holdings* to the benefit of smallholders or landless peasants. The reason land reform has this narrow meaning in the concluding chapter is that data constraints on variables such as tenure, tenancy, and landlessness, limit my analysis to the relationship between the size distribution of landholdings and food insecurity. Thus I can only assess the potential effects of a redistribution of landholdings on the basis of the results of the study.

This section has defined the concepts of land concentration and land reform. In the next section I will provide an empirical description of these and related aspects in the developing world.

4.2.1 Land Concentration

The purpose of this section is to provide a picture of the poor's access to land in the developing world. To fulfill this purpose, I will describe the size distribution of landholdings across regions in the developing world. However, this will only tell us part of the story, as the type of tenure that the land is held in affects the holder's access to the output of the land. For instance, a share cropped holding of two hectares where the tenant has to give 50 percent of his output to the landlord can be likened to a one-hectare owner-cultivated holding (with the same land productivity). Thus, I will try to modify the picture given by the size distribution of landholdings by providing information about land tenure arrangements. Together this will give us information about how land, and its output, is distributed among those who have land. However, it does not tell us how a large share of the agricultural population does not have access to any land.[10] Thus, we will also consider measures of landlessness (in the agricultural population).

In the conceptual scheme of the relationship between land concentration and food insecurity in Chapter 5, I will explain how and why agricultural land per

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the social structure in agriculture and spur development. The wider package of agrarian reform (which includes land redistribution, access to credit, infrastructure, irrigation and technology transfer for the poor) is necessary in order to give them the ability to realize their opportunities.

[10] The agricultural population is defined as those that are actively engaged in agriculture and their non-working dependants (Jazairy et al. 1992).

agricultural capita,[11] as well as agricultural land and labor productivity, influences food insecurity (and how these measures are influenced by land concentration). During this discussion, it may be useful to have some idea about the scope of these measures in today's developing world. Thus, Sub-Section 4.3.2 offers an introduction to this side of the agrarian structure.

There is considerable variation in the poor's access to land within the developing regions. Nevertheless, it seems fruitful to talk about a typical structure for: 1) Latin America and the Caribbean; 2) Sub-Saharan Africa; 3) The Near East and North Africa; and 4) South East Asia.[12]

Since the poor's access to land is of central importance in this thesis, I will spend some time examining data on the gini coefficient for the size distribution of landholdings and the prevalence of tenancy and landlessness. Gini coefficients provide information about inequality in the size distribution of land holdings.[13] The data on the prevalence of tenancy tell us how many percent of the holdings are rented. However, the do not say anything about the tenancy terms or the degree of exploitation the tenants have to put up with. Thus, I will supplement the data with a description of these aspects across the regions.

Tables 4.4.a to 4.4.d show the distribution of land holdings, the prevalence of landlessness in the agricultural population, and the share of holdings that are under tenancy in selected developing countries.[14] Here we can see that land is generally most concentrated in Latin America. If we take the average of the latest reported gini coefficients in each region, we can see that Latin America has the highest average: 0.72. This is very high, and considerably higher than the averages for the Near East and North Africa (0.55), South East Asia (0.48), and Sub-Saharan Africa (0.44) regions. Ten of the 25 Latin American countries in

[11] In Chapter 5 I discuss how agricultural land per agricultural worker (and not per agricultural capita) relates to food insecurity. However, these data are not available on a regional basis. In their place I will use agricultural land per agricultural capita.

[12] The discussion regarding Asia will sometimes refer to South Asia and other times to South East Asia, according to the availability of aggregate data. See World Bank (1999: 250-51) for a list of countries in each of the developing regions.

[13] The coefficient ranges from zero to one, where the value zero means that land is equally distributed among all holders, and the value one means that all of the land in the country is under one holding. Although there are shortcomings with this coefficient (see Section 6.2), it is generally accepted as the best available measure of inequality in access to land (Fields 2001).

[14] The countries in Tables 4.4.a to 4.4.d are selected on the basis of data availability.

Table 4.4.b have gini coefficients above 0.70 which is the benchmark for very high inequality (UNDP 1992, Table 4.2). This is twice as many as in the three other developing regions together. Kenya, Madagascar, Indonesia, Saudi Arabia and Algeria are the only countries outside Latin America and the Caribbean that have gini coefficients higher than 0.70.

With the high concentration of landholdings in Latin America and the Caribbean it is not surprising that landlessness reaches its highest levels (of the countries where data are available) in this region. In Costa Rica, as much as 44 percent of the agricultural population is landless, and the situation is not much better in El Salvador and Brazil, where the levels are 41 percent and 39 percent, respectively. Two Latin American countries are, however, on the opposite end of the scale. In Grenada, only five percent of the agricultural population is landless (but there is a high share of tenancy), and in Jamaica only four percent. The level of landlessness is also high in most South East Asian countries. The Philippines has the highest level, where 34 percent of the agricultural population does not have access to land; Malaysia has the lowest, with 12 percent; and the other eight countries (where data are available) have between 15 and 39 percent landlessness. It is easy to lose sight of the magnitude of the problem when we compare percentages across countries. Thirty percent landlessness may not seem very high as it is within the normal range. But, when we consider the fact that India, which has an agricultural population of approximately 500 million, has a 30 percent prevalence of landlessness, the numbers become more dramatic. In this country alone about 150 million people that depend on agriculture for a living do not have access to any land.

There are data on landlessness for only six countries in Sub-Saharan Africa. Five of these countries have low levels of landlessness: from two percent in Rwanda to 16 percent in Côte d'Ivoire. The level in Lesotho (26 percent) is higher than in these five, but it is not very high compared to many countries in Latin America and the Caribbean, and South East Asia. In the Near East and North Africa, Jordan, Iraq and Yemen have low levels of landlessness with only three, seven and nine percent, respectively. The highest level in the region is in Turkey, where 28 percent of the agricultural population is landless. Thus, the

situation is much the same as in the six Sub-Saharan countries where data are available.

Table 4.4.a: Land Concentration, Tenancy and Landlessness in Selected Countries in Sub-Saharan Africa

Country	Gini Coefficient for Landholdings			Direction of Change	Tenancy, % Holdings	Landlessness, % Agric. Pop.
	1970	*1980*	*1990*		*mid-1980s*	*1988*
Botswana	0.50				-	-
Cameroon	0.44	.42		♦	-	-
Chad	0.38				-	-
Congo	0.29				-	-
Cote d'Ivoire	0.42		0.36	♦	-	-
Ethiopia	0.32	.25	0.32	♦ ♣	-	16
Gabon	0.47				-	-
Gambia			0.38		-	-
Ghana	0.57	.44		♦	14	-
Guinea		.19	0.19	♥	-	-
Kenya	0.74	.77		♣	4	13
Lesotho	0.39		0.47	♣	-	26
Madagascar		.80			-	-
Malawi		.36			-	8
Mauritania		.36			8	-
Niger		.35			-	-
Nigeria	0.37				-	9
Rwanda		.39			3	2
Sierra Leone	0.44		0.44	♥	-	-
Togo		.45			21	-
Uganda		.60	0.62	♣	-	-
Zaire	0.37		0.39	♣	-	-

Notes: - means not available. Gini coefficients from 1966-1975 are placed under 1970, from 1976-85 under 1980 and gini coefficients from 1986-1995 under 1990.

Sources: Gini Coefficients: UNDP (1992: Table 2.2) and (1997: 198-99); Thiesenhusen (1995: 9); Alamgir, and Arora (1991: 99-100); IFAD (2001: 119), UCLA (1999: Table 205). Landlessness and Share of Land under Tenancy: Jazairy et al. (1992: 406-7 and 418-19).

Table 4.4.b: Land Concentration, Tenancy and Landlessness in Selected Countries in Latin America and the Caribbean

Country	Gini Coefficient for Landholdings			Direction of Change	Tenancy, % Holdings	Landlessness, % Agric. Pop.
	1970	*1980*	*1990*		*mid-1980s*	*1988*
Argentina			0.79		-	-
Bahamas			0.88		-	-
Barbados			0.92		-	-
Bolivia	0.60	0.55		♦	-	10
Brazil	0.84	0.86		♣	16	39
Chile	0.60		0.64	♣	-	-
Colombia	0.86	0.70	0.71	♦	-	-
Costa Rica	0.83	0.67		♦	-	44
Dominican R	0.79	0.70		♦	20	29
Ecuador	0.71		0.69	♦	27	23
El Salvador	0.81		0.57	♦	4	41
Grenada		0.69			52	5
Guatemala		0.85			12	21
Guyana		0.60			29	-
Haiti	0.50				20	-
Honduras	0.78	0.64	0.73	♦ ♣	56	26
Jamaica		0.68			21	4
Mexico	0.58				-	32
Panama	0.78	0.84	0.88	♣	67	25
Paraguay		0.94	0.91	♦	-	27
Peru	0.82	0.61		♦	-	19
Suriname		0.60			-	-
Trinidad & Tob.		0.61			24	-
Uruguay	0.82	0.84		♣	20	-
Venezuela	0.92				-	27

Notes: - means not available. Gini coefficients from 1966-1975 are placed under 1970, from 1976-85 under 1980 and gini coefficients from 1986-1995 under 1990.

Sources: Gini Coefficients: UNDP (1992: Table 2.2) and (1997: 198-99); Thiesenhusen (1995: 9); Alamgir and Arora (1991: 99-100); IFAD (2001: 119), UCLA (1999: Table 205). Landlessness and Share of Land under Tenancy: Jazairy et al. (1992: 406-7 and 418-19).

The system of customary land tenure dominates in Sub-Saharan Africa. In this system, it is the tribe that owns the land, and (male) members of the tribe have equal rights to its use. It is the responsibility of tribal chiefs to ensure that all eligible persons are allocated farmland. Rules for eligibility vary from tribe to tribe, and in some cases outsiders may even acquire land if they agree to certain conditions. This does not mean that everyone has equally large landholdings (see the gini coefficients in Table 4.4.a). Women often do not have independent rights to land as these rights are generally allocated to the (male) head of the household

(Jazairy et al. 1992: 108-125; Small 1997: 46). In addition to the use rights allocated a person (or a family), the commons constitute an important source of land in many Sub-Saharan countries.

Table 4.4.c: Land Concentration, Tenancy and Landlessness in Selected Countries in The Near East and North Africa

Country	Gini Coefficient for Land Holdings			Direction of Change	Tenancy, % of Holdings	Landlessness, % Agric. Pop.
	1970	*1980*	*1990*		*mid-1980s*	*1988*
Algeria	0.72				-	-
Egypt	0.32	.35		♣	30	25
Iraq	0.51	.35		♦	-	7
Jordan		.57			25	3
Morocco	0.59	.47		♦	12	15
Saudi Arabia	0.79	.83		♣	-	-
Syria		.59			-	-
Tunisia		.58			14	20
Turkey	0.54	.58	0.40	♣ ♦	2	28
Yemen		.64			-	9

Notes: - means not available. Gini coefficients from 1966-1975 are placed under 1970, from 1976-85 under 1980 and gini coefficients from 1986-1995 under 1990.

Sources: Gini Coefficients: UNDP (1992: Table 2.2) and (1997: 198-99); Thiesenhusen (1995: 9); Alamgir and Arora (1991: 99-100); IFAD (2001: 119), UCLA (1999: Table 205). Landlessness and Share of Land under Tenancy: Jazairy et al. (1992: 406-7 and 418-19).

Although customary tenure dominates in Sub-Saharan Africa, some countries have privatized some of their agricultural land. In Kenya, 20 percent of the land is privately owned, whereas in Côte D'Ivoire it is 17 percent, and in Malawi, 15 percent. However, tenancy on privately owned land is not common. An exception from this rule is Cape Verde, where as much as 61 percent of the landholdings are leased from private owners. In Southern Africa (Namibia, Zimbabwe and South Africa) there is a form of dualistic agrarian structure, where white farmers own land and blacks have access to land through the communal system (Jazairy et al. 1992: 108). This could, however, change with the abolition of apartheid in South Africa and the infamous land reforms in Zimbabwe.

Table 4.4.d: Land Concentration, Tenancy and Landlessness in Selected Countries in South East Asia

Country	Gini Coefficient for Land Holdings			Direction of Change	Tenancy, % of Holdings	Landlessness, % Agric. Pop.
	1970	*1980*	*1990*		*mid-1980s*	*1988*
Bangladesh	0.57	0.50		♦	23	20
India	0.64	0.55	0.43	♦	9 (15)*	30
Indonesia	0.72				-	15
Rep. of Korea	0.29	0.32		♣	-	-
Malaysia		0.51			-	12
Myanmar		0.41	0.44	♣	-	22
Nepal	0.62	0.61	0.33	♦	13	18
Pakistan	0.43	0.54	0.37	♣ ♦	36	30
Philippines	0.51	0.53		♣	33	34
Sri Lanka	0.51	0.64		♣	27	22
Thailand	0.46	0.46	0.36	♦	16	15

Notes: - means not available. Gini coefficients from 1966-1975 are placed under 1970, from 1976-85 under 1980 and gini coefficients from 1986-1995 under 1990. *According to Lastarria-Cornehiel and Melmed-Sanjak (1999: 9) the share of tenancy in India is 15 percent.

Sources: Gini Coefficients: UNDP (1992: Table 2.2) and (1997: 198-99); Thiesenhusen (1995: 9); Alamgir and Arora (1991: 99-100); IFAD (2001: 119), UCLA (1999: Table 205). Landlessness and Share of Land under Tenancy: Jazairy et al. (1992: 406-7 and 418-19).

A third form of agrarian structure can be found in Tanzania and Ethiopia, where the state formally owns all agricultural land and the people only have usufruct rights. In Tanzania, village governments allocate these use-rights to individuals, while peasant organizations exercise this power in Ethiopia. In the latter case, everyone who is over the age of 18, and a member of an acknowledged peasant organization, is entitled to usufruct rights to a parcel of land. Thus, the gini coefficient for landholdings is only 0.32, which is the lowest among all countries in this study (regardless of region). On the other hand, the highest gini coefficient for the size distribution of landholdings in this region is found in Kenya (0.77), which is the country with the highest share of privately owned land. Thus, it seems as if the generally low level of land concentration, landlessness, and tenancy, in Sub-Saharan Africa is a result of the customary land tenure system (and the state ownership of land) that dominates in this region.

In Latin America and the Caribbean, the agrarian structure is quite different from the structure in Sub-Saharan Africa, as it can still be characterized as a “latifundia” system. In this system, land ownership is concentrated in the hands of a few wealthy landowners. Because land on these large farms is often

acquired for reasons of status, or portfolio investments, vast areas of arable land lie idle in this region. Landless or land-poor laborers work on the large farms ("latifundias" or "haciendas") for very low wages. Alongside them is a peasantry that works tiny pieces of land, either within or outside the estates. The peasants' land is often rented from landlords (or pawned to a money-lender). The amount of land under tenancy is relatively high in Latin America and the Caribbean. For example, the share of tenancy is 56 percent in Honduras, 38 percent in Belize, and 67 percent in Grenada. The rent that peasants have to pay on land is most often around 50 percent of the output (either in cash or in kind), but in some countries they are forced to pay as much as 80 percent (Barke and O'Hare 1993: 85; Jazairy et al. 1992: 406-7, 418). Peasants often find themselves in a serf-like relationship to landlords, as they depend on them for continued access to land, for credit and market-access. Worse, the size of the rents that peasants have to pay on both land and loans can seriously jeopardize their room for maneuver.

A wave of land reforms swept over the Latin American region in the 1960s, 1970s, and 1980s. The most radical reforms were those in Peru, Bolivia, El Salvador, Nicaragua and Cuba, where between 22 and 60 percent of the agricultural land was redistributed, benefiting between 20 and 60 percent of the rural families (Jazairy et al. 1992: 113). Cooperatives were formed by the reforms in Cuba, Peru, El Salvador and Nicaragua, but this did not (as we can see from Table 4.4.b) lead to a major improvement in access to land for the poor. Previous to this wave of reforms, the latifundias constituted only about 5 percent of the number of farm units (but they owned approximately 80 percent of the land). In contrast, the minifundistas (small peasants), who constituted about 80 percent of the population, only had access to about five percent of the land. The land reforms changed this ratio to some degree but not enough to erase the bi-polarity. We still see a few very large, and a lot of (often rented) very small, but very few medium-sized farms (Kay 1997: 154). Most economic and political power is therefore still vested in the landlord-class, and peasants are marginalized in both terms.

Thus, despite very high gini coefficients for landholdings in Latin America and the Caribbean, the inequalities in access to the land's output is even worse than reflected by these gini coefficients because many of the smallholders are tenants. Since tenants have to pay rent to a landlord, their access to land is

really lower than the actual size of the holding. This is especially so in Panama, where as much as 67 percent of all holdings are rented, as well as in, for instance Honduras and Grenada where respectively 56 and 52 percent of the holdings are rented.

The agrarian structure in North Africa and the Middle East resembles the latifunda system in Latin America (El-Ghonemy 1993: 34; Barke and O'Hare 1993: 85), but the holdings are generally less concentrated and the incidence of tenancy and landlessness is normally lower (see Tables 4.4.b and 4.4.c). Abuse of the peasantry is still a serious problem in this region, though generally less than in Latin America and the Caribbean. The exploitation of tenants has been practically eliminated after tenure reforms in Algeria (1962 and 1970) and Iraq (1958 and 1970), and the conditions for tenants have improved considerably in Egypt after the land reforms (1952, 1961, and 1969). However, the situation for tenants in Tunisia and Yemen is less favorable, and resembles that of many Latin American tenants. In Tunisia, tenancy is not regulated by law, which puts the tenants at a high risk of mistreatment. In Yemen, tenancy terms leave the tenants with as little as 15 percent of the output in cotton producing-areas, and even inflict net losses on them in cereal areas (Jazairy et al. 1992: 120, 418; El-Ghonemy 1990: 217).

In South East Asia, the agrarian structure is dominated by owner cultivation. In most countries (where data are available) private individuals own more than 50 percent of the holdings of less than one hectare (Jazairy et al. 1992: 110). However, tenancy is also found. In India, for instance, between nine and fifteen percent of all holdings are under tenancy.[15] The percentages are higher in Pakistan, Sri Lanka and the Philippines, where 36, 27, and 33 percent of all holdings respectively, are held on some form of tenancy (see Table 4.4.d). The most dominant tenancy arrangement is sharecropping, and nearly 23 percent of all tenancy-holdings in Bangladesh are sharecropped. The vast majority of tenants is—as in Latin America and the Caribbean and, to a lesser degree, in North Africa and the Middle East—both dependent on, and are exploited by, their landlords. In the more developed regions of Asia there are also incidences of what is called "reverse tenancy", where owner-cultivators expand their holdings by renting in

[15] According to Jazairy et al. (1992: 418), only nine percent of the holdings are under tenancy; while Lastarria-Cornehiel and Melmed-Sanjak (1999: 9) state that 15 percent of the land is under tenancy.

land. In such reverse tenancy situations, it is often the tenants that have the most power in contract negotiations, because the "land-lords" are often marginal farmers whose land is not sufficient for subsistence (or small farmers who do not have oxen to work their land). Additionally, there are many small-to-small lease transactions, where both parties are more or less equal in status and bargaining power (Lastarria-Cornehiel and Melmed-Sanjak 1999: 9-10). Thus, the gini coefficient for landholdings also overstates the poor's access to (the output of) land in this region.

There have been attempts at reforming the agrarian structure in several Asian countries. Land reforms in Taiwan (1951 and 1953) and the Republic of Korea (1949) are generally looked upon as success stories because the poor won improved access to land, and because it is believed that the new agrarian structure (partially) spurred the remarkable economic growth that these countries experienced over the past few decades. However, the results of land reforms in Bangladesh (1950, 1961 and 1972) and Sri Lanka (1972) were disappointing for smallholders and the landless (Jazairy et al. 1992: 110-11).

So far we have only discussed how access to land is distributed. In the following section we will examine how much land is available to distribute among the agricultural population, as well the productivity of the land and those who work it.

4.2.2 Arable Land per Worker, and Agricultural Land and Labor Productivity

Although it is important to recognize that there can be great variation in the quality of land under consideration, it is useful to look at the availability of arable land (per agricultural worker) when considering the poor's access to land. It is a rough indicator of agriculture's potential for satisfying the needs of the people that rely on it for a living (as well as agriculture's ability to provide the industrial sector with food and raw materials). However, to get a more refined picture of the land's ability to provide for the needs of the population, we have to study land and labor productivity in agriculture. These measures are in focus in the latter part of this section.

Changes in arable land per worker can come about by growth or decline in the workforce (a result of population growth and/or increased labor absorption in the industrial sector), through expansion of the land frontier, land degradation, and/or because arable land is used for industrial or housing purposes. We can see from Table 4.5 that arable land per worker in agriculture has declined in the 15 years between 1985 and 2000 in both Sub-Saharan Africa and South Asia. The largest decline has occurred in Sub-Saharan Africa, where the average level of land per worker declined by 22 percent, from 0.99 hectares in 1985, to 0.78 hectares in the year 2000. This reduction in arable land per worker happened despite an increase in the total area of arable land of about 10 percent in the same period, because the agricultural labor force increased by approximately 35 percent (World Bank 2003).

Table 4.5: Arable Land per Agricultural Worker in 1985 and 2000

Region	Arable Land per Agricultural Worker (ha)		% Change
	1985	*2000*	
Sub-Saharan Africa	0.99	0.78	-22
Latin America & Caribbean	2.70	3.02	+12
South Asia	0.69	0.57	-17

Notes: Data are not available for the Near East and North Africa. The data are computed from the total area of arable land divided by the number of economically active persons in agriculture, both as defined by the FAO (2002b). Figures for the number of economically active persons in agriculture are the average for the years 1980 and 1990.

Source: FAO (2002b)

In South Asia, there is less arable land available per worker than in Sub-Saharan Africa and Latin America and the Caribbean. (Unfortunately, data from the Near East and North Africa region is not available.) We can see from Table 4.5 that South Asia had 0.69 hectares per worker in 1985, and that a 12 percent decrease left the region with only 0.57 hectares per worker by the year 2000. As there has been practically no change in the total amount of arable land in this region, the reduction is solely due to an increase in the agricultural labor force (World Bank 2003).

From Table 4.5 we can further see that Latin America and Caribbean is in an exceptional position. With the 2.7 hectares per worker in 1985, and the 3.02 hectares in 2000, there is much more land per worker than in the other regions. Latin America and Caribbean is also the only region where arable land per worker has increased in this period. The 12 percent increase in arable land per worker in

agriculture is mainly a result of a 10 percent increase in the total area of arable land (World Bank 2003).

From the review above we have seen that Asia has the least amount of land available per person that depends on agriculture for a living, and that Sub-Saharan Africa enjoys a somewhat better position. It is, however, important to keep in mind that while some farmers in Latin America have plenty of land, the vast majority suffers from land scarcity because of the highly unequal land distribution.

As I will discuss in Chapter 5, the possibility of producing enough food (and other necessary agricultural products) and generating enough income from the land available is determined by the level of land and labor productivity. The productivity of land and labor in agriculture also varies considerably between the developing regions. From Table 4.6 we can see that land productivity has increased in all regions between 1985 and 2000. However, the increase is of a much lower magnitude in Sub-Saharan Africa than in the other regions. The Near East and North Africa region enjoyed the highest land productivity in both 1985 and in 2000, with 885 US$ and 1,331 US$ per hectare, respectively. Land productivity in Latin America and the Caribbean follows closely behind, as it was 859 US$ in 1985 and 1,088 US$ in the year 2000. The levels are much lower in South Asia, where the land productivity has been only half of that in the Near East and North Africa, with only 442 US$ in 1985, and 700 US$ in 2000. The land productivity in Sub-Saharan Africa is the lowest of all. In this region it was only 338 US$ in 1985, and 419 US$ in 2000.

Table 4.6: Agricultural Land and Labor Productivity in 1985 and 2000

Region	Land Productivity		Labor Productivity	
	1985	*2000*	*1985*	*2000*
Sub-Saharan Africa	338	419	369	842
Near East & North Africa	885	1 331	--	--
Latin America & the Caribbean	859	1 088	2 463	3 962
South Asia	442	700	311	730

Note: Values are in constant 1995 US$
Source: World Bank (2003)

When it comes to agricultural output per worker, Latin America and the Caribbean are in a class of their own. In 1985, labor productivity in this region was 2,463 US$ per worker, which was more than six times the average for Sub-

Saharan Africa (369 US$), and almost eight times the level in South Asia (311 US$). In the year 2000, Latin America and the Caribbean's lead had shrunk, but the labor productivity of 3,962 US$ was still much higher than the 842 US$ in Sub-Saharan Africa,[16] and the 730 US$ in South Asia. There are no available estimates of labor productivity in the Near East and North Africa, but I have calculated the average of seven countries in the region (all the countries for which I could find data).[17] This estimated average was 1,748 US$ in 1985, and 2,180 US$ in 2000. If this average is representative for the region, this indicates that the Near East and North Africa has the second highest level of labor productivity, after Latin America and the Caribbean.

The levels of land and labor productivity in agriculture are important for developing countries because agriculture constitutes a large part of the economy, and has to provide for most of the countries' needs and incomes. Just to get an understanding of how the levels of agricultural land and labor productivity compares to that of developed countries, I might mention that in the year 2000, land productivity in the USA was estimated at 912 US$ per hectare, and labor productivity was 53,353 US$ per worker, while in France the land productivity was 2,828 US$ and agricultural labor productivity was 58,018 US$.[18] The level of land productivity in France is quite a lot higher than the levels we find in the developing regions, but in the USA it is actually lower than the average for Latin America and the Caribbean. However, the difference in the level of labor productivity between the USA and France, on the one side, and the developing regions, on the other, is striking.

[16] An average labor productivity of 842 US$ seems very high for Sub-Saharan Africa, as many of these countries had a level of agricultural labor productivity in the range of 150-450 US$ per worker in the same year. However, it can (partly) be explained by the fact that the agricultural labor productivity was 4,698 US$ in Mauritius, 3,861 in South Africa, and 1,104 in Côte d'Ivoire. These countries can also (partly) explain the high increase in the regions' average from 1985 to 2000 (despite an overall decline in arable land per worker), as the labor productivity in these countries increased by 24, 35 and 53 percent, respectively (World Bank 2003). However, we should keep in mind that data provided by institutions like the World Bank on developing countries are subject to several sources of error (as discussed in Section 1.1)

[17] These countries are Saudi Arabia, Egypt, Iran, Jordan, Morocco, Syria, Tunisia, and Turkey.

[18] The source of land and labor productivity in agriculture for the USA and France is World Bank (2003).

4.3 Summary

In this chapter we have seen that the developing world is crippled by food insecurity. According to the latest estimates (from 2000) more than 180 million children under five, (one in every three) are stunted as a result of inadequate food intake (and disease). Almost 130 million of these are found in Asia. However, measured in percent of the under five population, Sub-Saharan Africa has the highest prevalence of stunting, and it is the only region where an increase in the absolute number of stunted children is expected between 2000 and 2005.

While acknowledging that food supply and food security are different concepts, I also reviewed the past and present food supply situation in the developing regions. I have done this because one of my main hypotheses is that the level of food supply (availability) influences the level of food insecurity. Although the food supply is far from satisfactory in the developing world (with the possible exception of the Near East and North Africa), there has not been a decline in the *total* food supply in any of the regions. Only Sub-Saharan Africa has experienced a faster growth in population than in food supply, leading to a reduction in the per capita food supply.

To summarize the information on land concentration, tenancy and landlessness we can say that although there are strains of both private and state land ownership in Sub-Saharan Africa, customary tenure dominates in this region and land concentration is therefore relatively low. Moreover, the prevalence of landlessness and tenancy are also low. In Latin America and the Caribbean, as well as in Near East and North Africa, there is a bi-polar agrarian structure with a few large farms and many small farms (which generally produce high gini coefficients). However, there is a higher prevalence of tenancy and landlessness in the former region. In South East Asia, land concentration is only a little higher than in Sub-Saharan Africa and private ownership dominates, but there is also considerable tenancy and landlessness.

We have further seen that the Latin America and the Caribbean region has considerably more land per agricultural worker than Sub-Saharan Africa and South Asia, and a much higher level of labor productivity. Of course, this does not help the poor very much, since the landholdings are concentrated in the hands of a few and the level of landlessness is high. In South East Asia, land is less

concentrated (than in Latin America) and land productivity is relatively low, but land availability per worker is very low, landlessness is high, and labor productivity is the lowest of all the regions. Neither is this situation very promising for the poor. Sub-Saharan Africa has traditionally been relatively land-abundant, but high rates of population growth have changed this picture dramatically. Sub-Saharan Africa's average gini coefficient for landholdings is the lowest of the four developing regions, and it has relatively low levels of landlessness (insofar as the few countries where there is data are representative for the region). Labor productivity rates are the second lowest of the developing regions, while Sub-Saharan Africa is at the bottom of the list with respect to land productivity. In the Near East and North Africa, land concentration is relatively high, but not as high as in Latin America and the Caribbean. However, landlessness is generally lower in this region than in South East Asia, and Latin America and the Caribbean. Figures for labor productivity in the Near East and North Africa are not available, but the average land productivity rate is the highest of all regions.

In the two regions where tenancy is most prevalent (Latin America and the Caribbean, and South East Asia) the gini coefficients overstate the poor's access to (the output of) land. Moreover, figures on landlessness give us additional information on the poor's lack of access to land. However, I do not have data on enough cases to include the aspects of tenancy and landlessness in the empirical analysis in Chapters 6 and 7. To amend for this lack of data, I will include regional dummies that can possibly modify the information about access to land provided by the gini coefficient for landholdings, by capturing the different levels of tenancy and landlessness across the regions. These dummies will be explained further in Section 6.2.

The aim of this chapter has been to provide background information on the state of food insecurity and land concentration in the developing world. For this reason, it has been primarily descriptive. In the following chapter, I conceptualize how land concentration, the availability of agricultural land, as well as agricultural land and labor productivity influence the levels of both food availability and food insecurity in the developing world.

5

Land Concentration and Food Insecurity: A Conceptual Scheme

In Chapter 2 I discussed two main approaches to the study of food insecurity in developing countries: the entitlement approach and the food availability approach. The first approach sees food insecurity as a consequence of inadequate endowments at the individual level, while the latter describes food insecurity in terms of a food shortage at the country or regional (whether within a country or of a group of countries) level. Endowments include assets (such as agricultural land), incomes from cash cropping, incomes from wage labor (in both agriculture and industry) and rights to social transfers. Subsistence production (from the endowment of agricultural land) provides a "direct entitlement" to food, while the corresponding term "indirect entitlement" is a result of the exchange of endowments for food (between individuals or on the open market). Thus, indirect entitlements result from the terms of trade between endowments and food. Since food prices are influenced by food availability, I argued that people's endowments and the amount of food available in a country are both essential parts of an explanation for food insecurity. Endowments are essential because they reflect the resources that people have at their disposal, and that can be used to acquire food. The availability of food is important because there must be enough food to cover the needs of the population, but also because it influences the price of food, which rises when the supply of food is low (relative to demand). Thus, endowments are only relevant when measured in relation to the price of food, and the availability of food is only relevant when seen in combination with people's endowments. While the entitlement approach acknowledges that the price of food determines how much food can be derived from a given set of endowments, it downplays the price side of entitlements. On the other hand, the availability approach focuses on the quantity of food, downplaying the fact that the poor cannot access the available food when they lack endowments. Consequently, both

approaches stop short of a full understanding of the causes for food insecurity in the developing world.

In this chapter I will explore the theoretical linkages between land concentration and food insecurity in developing countries by clarifying how land concentration affects the poor's endowments and the price of food. This chapter explores the relationship between land concentration and: 1) direct entitlements; 2) the endowment side of indirect entitlements; and 3) food availability—and thereby the price side of indirect entitlements. Thus, I approach the study of food insecurity from a perspective that focuses on entitlements to food, but acknowledges that food availability is an important, and necessarily integrated, part of entitlements.

As pointed out by Maxwell and Wiebe (1999), assets can be (and are often) sold in order to buy food in bad years. This depletion of assets can jeopardize long-term food security, especially if peasants are forced to sell off some of their already small landholdings. To simplify the discussion, I have chosen to look at the endowments' side of indirect entitlements as *income*, and I will not distinguish between indirect entitlements derived from selling off assets and other income. The bottom line is this: if people have to sell assets to buy food, it is because they do not have enough income to buy the food they need (at the current price). However, I will only discuss aspects of income that are related to land concentration and agrarian structure. This implies that I will not discuss any form of social transfer programs such as social security payments, unemployment benefits, food-for-work, and so on.

To simplify the picture further, I assume that all potentially-food insecure farmers are subsistence producers who do not sell any of their produce on the market, and that peasants engaging in cash cropping are better off. In this way I avoid the problem of the divergent effects that food prices can have on poor peasants that depend on the food market for incomes and food. For these people, incomes will rise when food prices increase, but the effect on food insecurity is unclear because the food they have to buy will also be more expensive. For this reason, the food insecurity of cash croppers will not be considered here. In real life this simplification does not hold, because poor

peasants may also choose to grow cash crops.[1] However, for simplicity I choose to limit the discussion to the effect of land concentration on the food insecurity of subsistence producers and the landless (agricultural and industrial) workers.[2]

As discussed in Chapter 1, there are vast, but separate, literatures on food insecurity and land concentration. The food insecurity literature seldom discusses the possible effects of land concentration, while the land concentration literature seldom deals with food insecurity—much less on both rural and urban food insecurity. The main contribution of this chapter is to combine these literatures, and explain how land concentration affects food insecurity. The common perception of the relationship is that where land concentration is low (and more people have access to agricultural land) food insecurity will be low. However, the picture is much more complicated than this. The relationship is quite complex, as land concentration affects food insecurity through many different channels. It also affects food insecurity differently according to the channel and group of (poor) people under consideration. This chapter provides a conceptual scheme that structures the relationship between land concentration and food insecurity.

This conceptual scheme is graphically presented in Figures 5.1.a, 5.1.b, and 5.1.c. Figure 5.1.a shows how entitlements to food can be divided into direct entitlements (which is the same as subsistence production), and indirect entitlements (which are derived by income and the price of food).

Land concentration's relationship to direct entitlements is relatively straightforward, but the relationship with indirect entitlements is quite complex. Figure 5.1.b shows how land concentration influences direct entitlements to food (subsistence production) directly, and via agricultural labor productivity and tenancy relations. Furthermore, tenancy relations influence agricultural labor productivity. I will elaborate on all the causal relationships (arrows) in Figure 5.1.b—except for the relationship

[1] Cash crops refer to agricultural crops other than food crops, and include crops like coffee, tea, cotton, sugar, rubber, jute, tobacco, vanilla and coconut, etc., depending on the country concerned. Cash crops can be sold on the domestic market, or exported. Furthermore export crops can include both food crops and cash crops. Food crops are those that are important for a population's nutritional needs, and include crops like rice, wheat, maize, millet, sorghum, beans, cassava, banana, yam, groundnuts, and vegetables, etc., also depending on the country concerned (Jazairy et al. 1992: 468).

[2] This simplification can be justified by Brenner's (1997) argument that peasants often choose to diversify for subsistence instead of specializing for the market, out of "safety first" concerns (See Sub-Section 5.3.2).

between land concentration and labor productivity in agriculture—in Section 5.1. As explained below, the effect of land concentration on agricultural labor productivity will be discussed in a separate section.

Figure 5.1.a: Food Insecurity

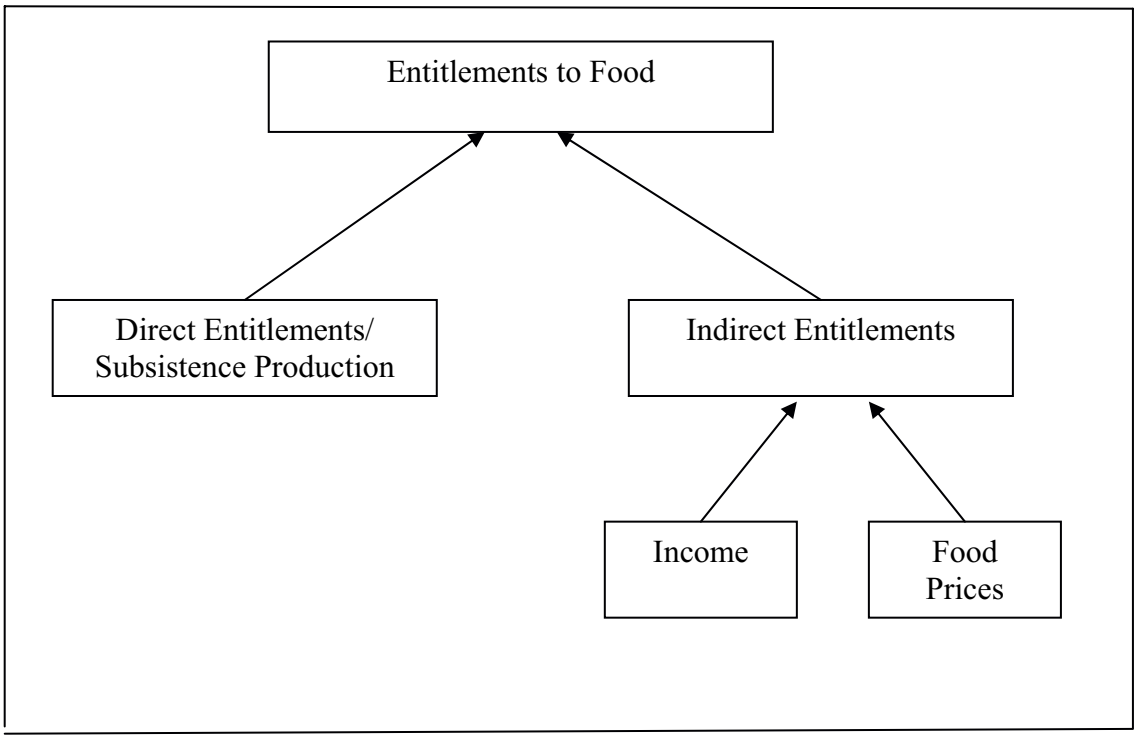
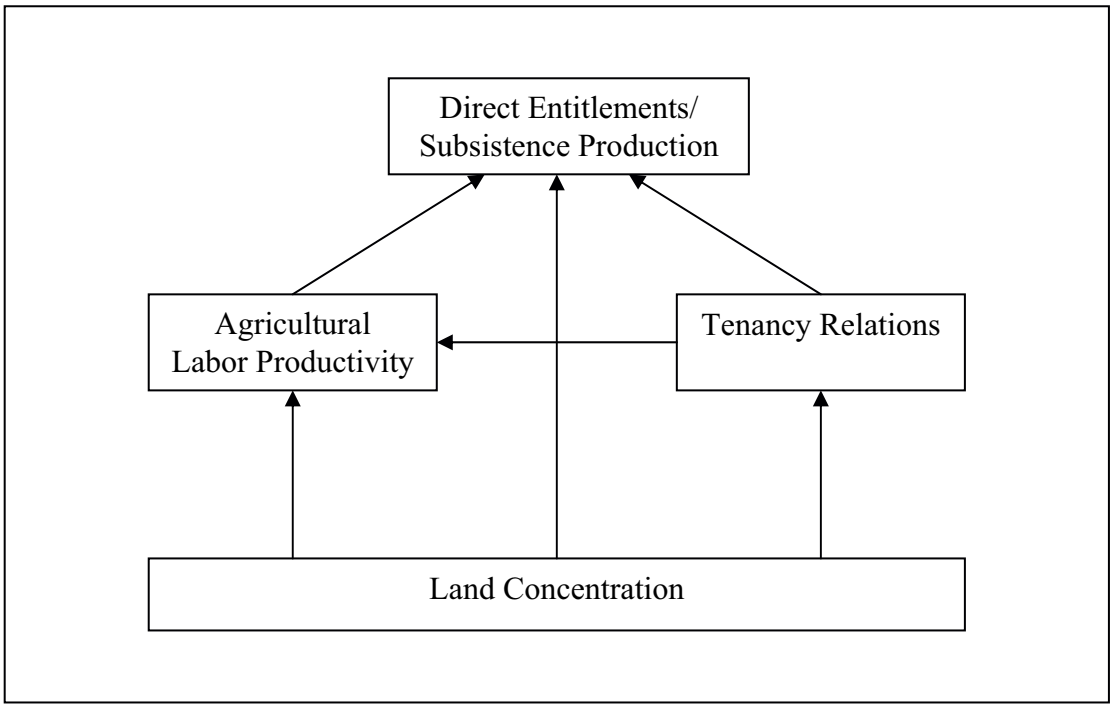


Figure 5.1.c (below) illustrates the complex relationship between land concentration and indirect entitlements to food. Land concentration influences both the income side and the price side of indirect entitlements. On the left-hand side of the figure we can see that land concentration affects the incomes of the landless agricultural workers via agricultural labor productivity and income distribution. In the middle we see how it affects the incomes of (landless) industrial workers via agricultural labor productivity (which in turn influences both the agricultural surplus and the demand for industrial products from agriculture), through government policy and income distribution. Finally, land concentration influences the price of food through its effect on food availability. The effects on food availability go via its influence on the type of

crops that are produced, agricultural labor productivity, and self-consumption in agriculture.

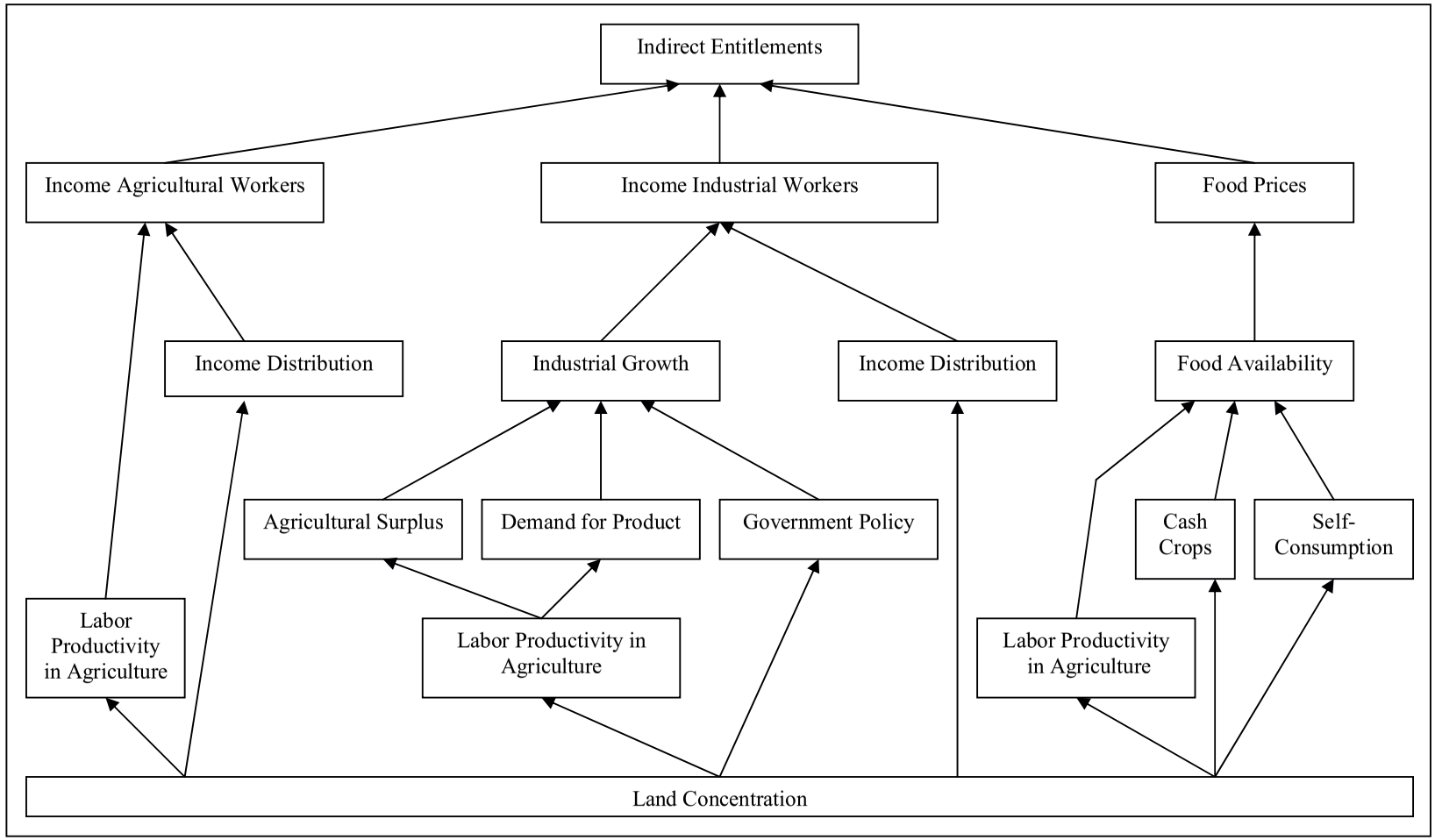
Figure 5.1.b: Land Concentration and Direct Entitlements



I explain these relationships (except for the relationship between land concentration and agricultural labor productivity) in Section 5.2. I will first describe the income side, and then the price side, of indirect entitlements. Sub-Section 5.2.1 describes the relationship between land concentration and incomes for workers in the agricultural sector, and Sub-Section 5.2.2 covers the incomes of workers in the industrial sector. I will discuss the price, or food availability, side of indirect entitlements in Sub-Section 5.2.3.

From Figures 5.1.b and 5.1.c (as well as from the discussion throughout this chapter) we see that labor productivity in agriculture is a key factor affecting: 1) direct entitlements; 2) the income side of indirect entitlements in agriculture and industry; as well as 3) food availability. Agricultural labor productivity is itself influenced by land concentration, which means that part of the relationship between land concentration and

Figure 5.1.c: Land Concentration and Indirect Entitlements



food security goes via labor productivity in agriculture. In order to avoid repetition, I have chosen to focus my discussion of the relationship between land concentration and labor productivity in agriculture in Section 5.3. Section 5.4 provides a summary.

The conceptual scheme presented and described in this chapter is meant to provide an understanding of the complexity of the relationship between land concentration and food insecurity. When I analyze the relationship in Chapter 7, I will test a simpler model. Simplification is necessary because there aren't enough comparable data available to test all of these relationships (across a high enough number of developing countries that we can generalize about the results). Thus, the availability of data restricts the complexity of the model I will eventually test.

5.1 Land Concentration and Direct Entitlements

Direct entitlement to food is derived from the subsistence production of food. The relationship between land concentration and direct entitlements concerns whether peasants with rights to use (some) land are capable of producing enough food to feed themselves and their families, even if they have to part with some of their produce as "land rent" to a landlord. There is also an underlying question of whether subsistence producers have better food security than wage workers (in agriculture or industry).

El-Ghonemy (1990) argues that those who have access to land have better food security than landless workers. He writes:

> " In situations where industry is in its infancy and agriculture is the main source of employment, a landless worker faces two kinds of fear and uncertainties in acquiring food. One is the unstable flow of income from hiring out his or her labour and the other is his or her dependency on the power of grain traders in an imperfect market mechanism. In both cases, he or she is subordinated by fear and indignation. But the peasant who owns or controls a small piece of productive land has, on the other hand, a higher degree of certainty and independence in acquiring most of the household's food from his or her holding. Thus, the latter has more power in commanding food than the former" (El-Ghonemy 1990: 106).

If subsistence producers have better command over food than the landless, low levels of land concentration would generate food security (because more people would have access to land).

However, as direct entitlement to food is achieved through the production of food for self-consumption, low land concentration only provides the poor with the *possibility* of producing food for their own consumption. As illustrated in Figure 5.1.b, whether they can produce enough food to remain food-secure depends on two things: 1) their labor productivity; and; 2) how tenancy relations intervene. Land concentration influences both of these factors.

The critical issue for subsistence producers is whether or not they can produce enough food from their small piece of land. Thus, in order to be food-secure, subsistence producers need a piece of land that is large enough and productive enough to sustain the peasant family throughout the year. The size and land productivity of the holding cannot be considered apart from the number of people that work the land and depend on it for their (and their family's) food security. If the land productivity of the holding is high because labor intensity is high, the output may not be large enough to feed all of the workers. Thus, labor productivity is the critical measure for food security of subsistence cultivators. If, for the moment, we set tenure relations aside, the relationship between labor productivity and food security for subsistence producers is simple: higher labor productivity means more food available for consumption.

With a given amount of agricultural land in a country, its distribution will have implications for the average size of the farms and the share of the agricultural population that is landless. The higher the level of land concentration, the smaller the numbers of people with access to land, and the (average) holdings will be large. A consequence of this distribution pattern is that a high share of the agricultural population will be landless. When land concentration is low, more people have access to land, a lower share of the population will be landless, but the holdings will be smaller. When holdings are small, it may be difficult for peasants to produce enough food to be food-secure—even if the land is intensively cultivated and the yields are high—because the output per person may be too low. Thus, where land is scarce (in relation to people) we are faced with a choice between: 1) (re)distributing land to as many people as possible; and 2)

providing enough land to some of the people, thus rendering the rest landless.[3] In short, we cannot say that low land concentration necessarily means high food security in the agricultural population: when more people have access to land, the holdings may be too small for survival. Thus, whether low land concentration will lead to low food insecurity depends on the amount of people that rely on agriculture for a living, in relation to the amount of land and the land's productivity. In other words, low land concentration will give low food insecurity when the land/labor ratio and the level of land productivity combine to give the peasants sufficient labor productivity. In Section 5.3, I will discuss how land concentration affects the potential for improving labor productivity on small farms.

While owner-cultivators will be able to reap all the benefits of their labor, tenants must share them with a landlord. For this reason, it is not sufficient to measure the quantity (and quality) produced by the tenant in light of the needs to sustain the family. When land is rented we need to recognize that the peasant must sell some of the produce (or give in-kind) in order to pay rent to the landlord.

Tenure agreements determine how much of the production a tenant can keep. In their comprehensive review of the contemporary land tenure literature, Lastarria-Cornehiel and Melmed-Sanjak (1999: 50) conclude that there are three basic issues that influence the decisions of both landlords and tenants when forming tenancy contracts. First, both landlords and tenants try to maximize income potentials when they enter a tenancy agreement. The landlord attempts to maximize income by finding solutions to agency problems (e.g., shirking in work effort and incentives to increase productivity of the land). Second, while the tenant tries to maximize income from the tenancy agreement, he is even more occupied with minimizing income variability (risk management). Third, the agrarian structure (land distribution and labor supply) determines the bargaining power of the two parties, and influences the outcome. Where land is concentrated in the hands of a few, and the labor supply is abundant, tenants have little power in the negotiations.

[3] This is a dilemma similar to Ehrlich's (1969) "lifeboat ethics": it may be necessary to deny some people access to the lifeboat in order to prevent it from sinking, so that the lives of the lucky few that are already onboard will be saved.

In addition, Bhaduri (1999: 87-104) argues that it suits the interest of the politically and economically superior landlord class to keep the labor productivity of their tenants down. Under the semi-feudal conditions that prevail in large parts of Asia and Latin America, the landed class can actually maintain higher levels of income if they hamper the productivity of the peasantry. In this way the landowners perpetuate the peasantry's dependence on them for land and credit, and thereby secure future incomes. Thus, where ownership to land is concentrated, the "class-efficiency" of the landed upper class hinders growth in labor productivity on leased smallholdings.

Brenner (1997) argues that agricultural growth will only occur under capitalist social property relations where workers are separated from their means of subsistence. Under feudal-like property relations—as is common in many developing countries today—the economic rationality of both peasants and landlords will not lead to agricultural growth, but rather to underdevelopment and social crisis. Peasants will choose to stay independent of the market and diversify their production in order to supply themselves with all their subsistence needs. Thus, the basis for agricultural growth—which is specialization, reinvestment, and technical innovation in order to maximize the price/cost ratio—fails to appear. Furthermore, landlords often have greater incentives to increase their income by squeezing their tenants than by increasing production.

This section has showed that the relationship between land concentration and direct entitlements from subsistence production is not quite as simple as it may seem. Contrary to common perceptions, low land concentration does not automatically reduce the prevalence of food insecurity (in the agricultural sector). The balance between (on the one hand) people and (on the other) the amount and productivity of the land, determines whether peasants can produce enough food to be food-secure. If the population is dense, a lot of people will be landless, even if land concentration is low. Under these conditions, there will be a tension between access to land for the landless and securing large enough holdings for the peasants to survive. Furthermore, subsistence producers are often tenants and have to share their output with a landlord (who is often interested in keeping the tenants' labor productivity down). The tenancy terms are influenced by the relative power of the tenants and landowners. The more concentrated

is the *ownership* to land, the more people that are landless, the harsher are the tenancy terms, and the tenants will be less food-secure. Since high land concentration will produce many landless, the number of landless will be greater the more people are found in the agricultural sector. In addition to affecting the food insecurity of the subsistence producers, as explained in this section, high land concentration may be problematic for the landless agricultural population in their own right. This is the focus of the following section.

5.2 Land Concentration and Indirect Entitlements

We have already discussed that indirect entitlements to food (for the poor) are a function of the level of income compared to the price of food (see Figure 5.1.c), and that the price side is as important as the income side because it is the relationship between them that determines people's access to food. In this section I will first discuss how land concentration influences indirect entitlements through incomes of the landless workers in the agricultural sector. I will then discuss how land concentration affects incomes of workers in the industrial sector. Last, but not least, I will discuss how land concentration influences the price of food through food availability.

5.2.1 Land Concentration and Income of Landless Agricultural Workers

Land concentration can potentially influence both the (aggregate) income level and the income distribution in agriculture (see Figure 5.1.c). Wages for landless agricultural workers depend on two factors: 1) how much he or she is able to produce; and 2) the distribution of income between the landowners and the workers. Output per worker is more important than land productivity for determining incomes in agriculture. If output in agriculture grows because more labor is added, output per worker may level-off or even decline, and their welfare will not improve. Thus, from a food security point of view, the landless agricultural population depends on increased *labor* productivity in agriculture. As already noted, the influence of land concentration on labor productivity in agriculture will be discussed later, in Section 5.3. We will now turn to discuss

whether we can expect wages in agriculture to rise if labor productivity increases (or, if workers can increase their wages even if their productivity does not grow). [4]

There is, of course, a possibility that agricultural workers can enjoy higher wages if their labor productivity increases, as the net product to be distributed between the workers and the landowners will increase.[5] When fewer people have participated in the production (of a given output) there will be less people to divide labor's share of the revenues. If many workers are needed to produce a crop, each worker will get less. This is easily illustrated by the extreme situation where labor productivity is so low that the revenues from the farm are too low to cover (any) wages for all the workers. But, high labor productivity in agriculture does not automatically produce higher worker incomes. Whether growth in output per worker actually translates into higher income for these workers depends on the nature of the power relations (with regard to income distribution) between landowners (capital) and labor.

When land concentration is high, workers are less powerful in their relations with landowners. This is because high land concentration tends to produce high levels of landlessness, and a greater supply of agricultural workers. On the other hand, the demand for labor will be low because large farms generally employ labor saving technology (see Section 5.3), which means that labor intensity is lower on large farms. Thus, the supply of labor will be much higher than the demand for it, and because of the "unlimited supply of labor" at the given wage-rate, the workers will have little power to command higher real wages (Lewis 1954).[6]

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[4] Even though we are not primarily concerned with the food security of cash croppers (or subsistence producers that sell some of their produce on the market), it is worth mentioning that when they (the cash croppers) increase their labor productivity, they can produce more of the same crop than before and thereby sell a higher quantity of that crop on the market. Whether this translates into higher incomes depends on the price elasticity of their products. The price may decline if there is a general increase in labor productivity so that the total supply of their crop increases. It is therefore possible that cash croppers' income will stand still (or drop) even if their labor productivity increases. (This is a point discussed in Prebisch 1959.) However, their entitlements to food may improve if average labor productivity in agriculture increases, because the price of food will most likely decline and they will be able to buy more food for the same income.

[5] Assuming that prices don't fall (as a result of the increased crop quantity).

[6] I will go further into Lewis' argument in Sub-Section 5.2.2 when I discuss the income of industrial workers, whose wages this theory originally dealt with.

The high landlessness that is associated with high land concentration problematizes collective action by the landless agricultural workers. Although it is possible to detect some common interest among landless workers, the varying interests of those that are employed and the unemployed can easily overshadow this commonality. Thus, landowners can take advantage of this conflict and fire (or fail to rehire the following season) those who demand higher wages or go on strike. In short: when land concentration is low, there are fewer landless, more landowners, and the landless may enjoy more power.[7]

Since agricultural workers often have little power to command the redistribution of large landowners' income or wealth, they could seek support from governments. However, owners of large farms typically have much more political power than the poor landless population, because governments (whether democratic or not) often rely on the economic and political support of the land-owning class.

In particular, large landowners can expect to yield more political influence in light of their ability to overcome collective action problems. Mancur Olson (1965) argues that small groups find it easier to organize than large groups because the costs of organization are low, and the benefits for each member of the organization are high. The costs of organizing a large group are high, because (for example) there will be many individuals that need information, and these individuals may not have (or perceive to have) the same interests. The benefits for each member of a large group will be relatively low, so that they will not be willing to pay the high costs of organization. In addition, it may be difficult to exclude free riders from these benefits. Following Mancur Olson, we can expect that the diffuse interests of the large group of landless agricultural workers will prove difficult to organize in an effective manner. In contrast, the landowning elite will find it easier to organize, and can thereby influence political outcomes more effectively. Landowners will also find it easier to organize because they are generally better educated than the landless, and will have more of both the economic and the "social" resources needed to partake in organizational work (Tilly 1978: 69).

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[7] A more thorough discussion of the relative power of landowners and landless workers would require that I address theories of collective action, the power and politics of labor unions, Marxism, political support, as well as revolutions. These are all vast theoretical areas, beyond the scope of the current project.

In short, landowners are often capable of stopping, or minimizing, the harm inflicted upon them from wage claims by workers and/or governmental redistribution policies. This makes it improbable that much of the gains (if any) from higher labor productivity will fall into the hands of landless workers. This is why Thiesenhusen (1995: 23) argues that the free market fails to transfer the gains from agricultural growth down to the rural poor, and that some form of government intervention is needed. He suggests that land reform is one of the major ways to improve conditions for the rural poor.[8] Several studies support this relationship between land concentration and poverty. El-Ghonemy (1990: 172-4), for example, studies the relationship between land concentration and the percent of the rural population in absolute poverty in 20 developing countries (with data on land concentration for the years 1973 to 1986). He finds a strong positive relationship, where the coefficient of correlation is 0.83 and the R^2 is 0.69. He also finds that the relationship is independent of the country's average income per person. Tyler et al. (1993) studied the relationship between land concentration and (a head count ratio of) rural poverty. They found that—with an agricultural growth of three percent per annum—it will take more than sixty years for the trickle-down effect to alleviate poverty by fifty percent. They concluded that some form of redistribution is necessary in order to improve the situation of the rural poor, and they indicated that a decrease in the concentration of land would have a considerable effect.

However, the relationship is not that straightforward. One reason is that the political power of the landed elite can influence distribution policies (such as land reform) so that they do not necessarily improve conditions for the rural poor. Thiesenhusen (1995) argues that "[i]n Latin America land reform became a policy by which only "rich" and articulate peasants benefited. …The standard of living of the unorganized masses may have been hurt each time a smattering of better off peers was advanced" (p. 176). Since governments sometimes have subtle motives (or simply are

[8] The other means that he considers effective in alleviating rural poverty are: 1) to channel more resources (in the form of inputs, credit, technology, education, and health services) to smallholders in order to increase their productivity; 2) to increase farm and non-farm employment opportunities for the rural poor; and 3) to subsidize the rural poor through food stamps, food rations, etc.

incompetent), land reform often ends up in "giving with one hand and taking with the other". Governments often fail to provide the necessary inputs (such as credit, irrigation, seed, fertilizer and knowledge) that peasants need in order to reap the benefits of reform. Governments are also faced with the dilemma of satisfying either the rural or the urban sectors, because the cost of satisfying both sectors concomitantly is too high. Thus, after the initial granting of land, governments often pursue policies that help the non-beneficiary groups—policies that have adverse effect on the land recipients. In conclusion, Thiesenhusen argues that if lower land concentration (that results from reform) is to have a beneficial effect on poverty, agricultural extension programs for peasants are necessary, at least during a transition period. Without such programs, the peasants will not benefit from their improved access to land.[9]

In *The Political Economy of Rural Poverty: The Case for Land Reform,* El-Ghonemy (1990) compares the performance of agriculture after partial land reform, where only some land is redistributed (in ten developing countries), with examples of complete land reform, where all agricultural land is subject to the reform (in four developing countries). He finds that countries with complete land reforms perform better with respect to annual average growth rates of agricultural labor productivity. He explains the difference in performance in terms of the dualistic agrarian structure that is created by partial reforms. Previous landlords that now operate in the non-reformed sector hold on to the best land, and have substantially more capital than the peasants in the reformed sector. Where these landlords are able to retain considerable power (more power than the reform-beneficiaries), they can continue to determine agricultural policies. In fact, many governments choose partial reform instead of complete reform in order to minimize the damage to the landlords, and thereby maintain their political support. These findings suggest that a bipolar agrarian structure (where a few farmers

[9] Closely related to the literature on land reform and tenancy reform is the subject of rural credit markets, and the interface between economic power and political influence, which again generates further economic power. Large landowners get most of the formal-sector credit, and at better terms than do peasants. The reason for this is not related to risk (large landowners default as often or more than the peasants), but that the large farmer uses his influence to get the bulk of the rural credit. Large farmers also face less bureaucracy and smaller transaction costs than the peasants (Basu 1994: 6-12).

have a lot of land and power, and the majority have very little of both) is unfavorable to labor productivity on the small farms.[10]

Thiesenhusen (1995) also finds that a bipolar agrarian structure (which results from partial reforms) is unfavorable for labor productivity on smallholdings. He argues that production increases after agrarian reforms are due to modernization in the non-reform sector (and not in the reformed sector). He claims that the most enduring effect of land reform in Latin America is increased agricultural commercialization. Landlords were able to keep the best land and attract the bulk of the credits and other inputs that followed the reform. The beneficiaries received too little land and support, and were therefore not able to attain a high enough level of labor productivity. Thus, reform beneficiaries had to seek extra work on the larger farms, which could still benefit from a cheap supply of labor as the reform "beneficiaries" could not earn a living off their land.[11]

In this sub-section I have discussed the relationship between land concentration and the income of the landless agricultural population. The main conclusion from this discussion is that even if we should find that labor productivity is higher on large farms, it is possible that higher land concentration will generate lower food security for the agricultural population, as the wages for landless agricultural workers are low. There are two main reasons for these low wages (in addition to the generally low level of labor productivity in developing country agriculture: 1) workers have little power in their relation to the landowners (their employers), and wage claims will not be met; and 2)

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[10] However, El-Ghonemy's analysis lacks comparison with countries that have not undergone land reform. In order to illuminate how land concentration, and partial versus complete reforms, affects agricultural performance and poverty alleviation, it is also necessary to compare against cases of no reform (and control for other relevant variables that may explain variation in these growth rates). This thesis aims to (empirically) study the relationship between land concentration and food insecurity and includes countries with high, medium, and low levels of land concentration. To some degree, this would illuminate the potential for land reform to improve food security, but it will not measure the actual effects. Actual effects will vary not only because they result in different levels of land concentration, but also because of disruptions with change of owners, and agricultural extension policies.

[11] If high labor productivity leads to high food availability, which again leads to lower food prices, it is uncertain whether agricultural laborers will improve their food security. Even though they produce more, the price of what they produce decreases, the revenues of the landowners may not increase, and the wages might remain the same (or even drop). In this case, the landless' purchasing power over food will depend on how much food prices decrease in relation to the increase/decrease in their wages.

workers often have less influence on government policies than the landowners. Where land concentration is high, the potential to decrease food insecurity for the landless by redistributing income or land may therefore be hampered by the economic and political power of the landowners. If land concentration were low there would probably be fewer landless, and the power and the wages of the landless might be better.

5.2.2 Land Concentration and Income of Industrial Workers

The landless in agriculture can also compete with industrial workers for work in the industrial sector. The problem is that the industrial sector in developing countries is small, and does not absorb much labor. Thus, there are already many unemployed industrial workers. In order to increase the possibilities for industrial income, this sector needs to grow. Land concentration can influence industrial growth through three main channels: 1) the supply of agricultural surplus, 2) the power and autonomy of developmental states, and 3) the effective demand for industrial products.[12]

As is the case with agricultural workers, there is no guarantee that industrial growth will bring higher wages to industrial workers. Power relations between capital and labor will also determine the distribution of income in the industrial sector. Thus, theories concerning the relative power of landlords versus landless workers can, to a large degree, also explain wage levels in industry. These links are the focus of the discussion in this section, where we will discuss how land concentration can influence overall economic growth and the distribution of income in industry.

The agricultural surplus is the share of agricultural production that is not consumed in the agricultural sector, and that is made available (most often through the market) for the industrial sector. Theories on how the agricultural surplus influences industrial growth belong in the "Dual Economy Perspective" that was spurred by Arthur Lewis' (1954) article "Economic Development with Unlimited Supplies of Labor", and developed further by, among others, Kalecki (1971), Kaldor (1967), Fei and Ranis (1964 and 1966) and Bhaduri (2003). Skarstein (1997: 82-83) has, with reference to Kaldor

[12] There are, of course, other factors than land concentration that influence industrial growth, but these are beyond the scope of this thesis.

(1967: 54-59), summarized the importance of the agricultural surplus for economic growth in the industrial sector in four points:

1) The agricultural surplus is the industrial workers' source of food. Employment in the industrial sector cannot grow faster than the ability of agriculture to generate a food surplus (large enough to feed the industrial workers). If the industrial labor force grows too fast for agriculture to provide them with food, severe food shortages and/or rapid inflation will result.
2) The industrial sector is dependent on raw materials from agriculture. If agriculture (or, more correctly, the primary sector) cannot generate a surplus of raw materials, growth in industry will stagnate.
3) In underdeveloped countries, where industrialization has not yet gained momentum, agricultural exports are the most important source of foreign exchange earnings. Infant industries are dependent on imports of capital goods, but are not competitive enough to sell much of their output on the world market. Growth in the industrial sector is therefore dependent on agriculture's ability to produce a surplus that can be exported out of the country.
4) Since the industrial sector depends on food, raw materials and capital from the agricultural sector, and imports of machinery (for example) from abroad, it needs to "export" some of its output to the agricultural sector (or to other countries, but this is difficult because of their low level of competitiveness). Thus, growth in the agricultural surplus is necessary in order to generate the effective demand needed to sustain industrial growth.

I might add that the importance of the agricultural surplus is reinforced by the fact that most developing countries operate under serious foreign currency constraints, and they cannot substitute domestic agricultural production with imports of food.

Land concentration enters the picture because it affects the level of labor productivity, which again affects the agricultural surplus because it determines how much the workers in agriculture can produce. Subsistence producers with low labor productivity will have to consume most (or all) of what they produce, and very little (or nothing) is left over to sell on the market. Most of what agricultural wageworkers

produce reaches the market (see Section 5.3.3, below). However, labor productivity is also important on the large farms, as the more the workers produce, the more reaches the market. In addition, land concentration influences self-consumption in agriculture, which again influences the size of the agricultural surplus. Self-consumption refers to the share of the product that subsistence producers and agricultural workers consume.[13] The higher this consumption, the less output will be available for industrialization. Self–consumption in agriculture does not only influence industrial growth, it also influences food availability for the net buyers of food. Because of the importance of this relationship, we will discuss the dynamics of self-consumption in agriculture in Section 5.2.3.

However, the level of land concentration can also influence industrial growth through the power relations between the land owning elite and the government. According to Adrian Leftwich (1995), the exceptional industrial growth in Taiwan and South Korea (and partly in China) can be explained by the existence of what he calls "the developmental state". He defines the developmental state as: "States whose politics have concentrated sufficient power, autonomy and capacity at the center to shape, pursue and encourage the achievements of explicit developmental objectives, whether by establishing and promoting the conditions and direction of economic growth, or by organizing it directly, or by a varying combination of both" (Leftwich 1995: 401). An important precondition for this sort of state is a relatively weak landed (upper) class (relative to the state's power). Where the landed class was initially strong, these states pursued land reforms in order to break their political hegemony. It was then possible to pursue policies that could spread the gains of economic growth to larger groups of people, and thus form the basis for dynamic domestic markets. Leftwich contrasts the experiences of these East Asian States with those in most Latin American countries (where the landed upper class enjoys much greater political power). He concludes that the East Asian developmental states possessed enough autonomy to attract foreign capital and simultaneously set conditions on capital in order to make it serve domestic developmental goals (Leftwich 1995: 417).

[13] In this discussion I will liken agricultural wageworkers with the industrial population, as both groups are net-buyers of food.

Redistribution of land is also seen as an impetus for industrial growth through raising effective demand. Developing countries typically have a small domestic market; because such a large portion of the inhabitants is poor, only a small elite participates in the money economy. Thus, the domestic market is too small to sustain a growing domestic industry. Rather than using exports to expand markets, land redistribution can expand the domestic market by improving the poor's economic situation and raising effective demand for simple consumer goods (that can be produced domestically). As argued by Prosterman et al. (1990: 312): "Land reform can generate increased overall economic activity, including the creation of nonagricultural jobs. As a broad base of agricultural families benefiting from land reform receive higher incomes, they enter the market place for a range of locally produced goods and services." This argument assumes that incomes among the poor will be higher, and more evenly distributed, after land reform. As discussed in the previous section, this is not necessarily the case.

Along these same lines, Barraclough (1973: 30; 1991: 78) argues that insofar as land reforms serve to redistribute income from the rural rich to the rural poor, the demand from the agricultural sector for industrial products will most likely rise. Barraclough suggests that such an "internal market" strategy for industrial growth, which relies on increasing demand from the country's poor, will give more immediate poverty alleviation than an export-led strategy. In the latter strategy the industrial sector's need for food and raw materials are favored above increased consumption in the agricultural sector. Low land concentration can also help reduce poverty because the demand for farm labor is higher when land concentration is low. Large farms, which are generally relatively highly mechanized, have a much higher land/labor ratio than smaller farms, and are much more likely to have capital-intensive growth (Binswanger et al. 1995).[14]

A common argument against the more equitable distribution of income that is sought through land reform is that the capital accumulation of the large landowners will disappear, consequently reducing investments in industry. This argument is based on the

[14] However, in order for the agricultural sector to sell its surplus, there must be an effective demand from the industrial sector. Thus, there is reciprocal dependency on effective demand in the two sectors of the economy.

assumption that the rich invest most of their income in domestic production (and thereby contribute to economic growth). However, studies from developing countries with high land concentration have shown that large landowners spend most of their income on consumption of foreign goods and travels, while very little (about 15 percent) was invested. Of these investments, a considerable portion was in land, foreign stocks and bonds, or in the construction of luxury hotels and apartments (Barraclough 1973: 31).

This far I have traced the relationship between land concentration and the aggregate income side of indirect entitlements to food in the industrial sector. Another important aspect of the incomes of the poor in the industrial sector is how the fruits of industrial growth are distributed. Lewis (1954) argues that the wage level in industry depends on income levels in agriculture, because peasants and agricultural workers will not seek employment in industry if the wages in industry are lower than what they can earn at home (Lewis 1954: 148-9).[15] Thus, the income level in agriculture determines the minimum wage in industry. (Lewis argues that, for several reasons, the minimum wage will be 30-50 percent higher than the agricultural wage.) At this wage level, Lewis argues, the supply of labor will be unlimited, "which means that if capitalists offer additional employment, there will be far more candidates than they require: the supply curve of labor is infinitely elastic at the ruling wage" (Lewis 1972: 77).

Lewis' argument builds on the premise that there is (disguised) unemployment in agriculture. In the previous Sub-Section (5.2.1) I argued that high land concentration would probably produce low wages for (landless or land poor) agricultural workers, because high unemployment among landless agricultural workers made them replaceable and because collective action problems render them powerless in relation to the landowners and the government. The high landlessness associated with high land concentration also means that the supply of labor for the industrial sector will be high. Thus, the power of the industrial workers in their relations with capital owners, as well as with governments, will also be relatively weak when (agricultural) land concentration

[15] Lewis uses a distinction between traditional and capitalist sectors, not agricultural and industrial sector as I do here. These categories do not overlap completely, as the traditional sector also includes several un-capitalistic urban activities such as domestic work, handicrafts, etc.

is high. Hence, land concentration may influence both the minimum and the maximum wage levels in industry.

To summarize, I have used Section 5.1 to examine the relationship between land concentration and direct entitlements, and Sub-Sections 5.2.1 and 5.2.2 to discuss how land concentration affects the income side of indirect entitlement to food for the landless agricultural population and the industrial workers, respectively. The motivation for this examination has been to find out whether smallholders are more food-secure than the landless. It has become evident that the answer to this question is not as simple as initial appearances might suggest.

As far as direct entitlements are concerned, low land concentration gives (at least some of) the rural poor the possibility of producing the food they need. Their ability to do that will depend on how much land they have access to, and the productivity of that land (or, in other words, their labor productivity). Furthermore, tenancy relations determine how much of the output can be consumed by subsistence producers. Since most developing countries are densely populated, one can expect to find a tension between the landless (that want access to land), and the subsistence producers' need for large enough holdings to ensure their food security.

The incomes of landless agricultural workers are probably lower when land concentration is high (than if land were distributed more equally). This is probably true because there are more landless people when a few people own most of the land, and the more landless there are, the less power they have to command higher wages (from landowners) or redistribution policies (from governments). Having said this, landless agricultural workers have a better chance of acquiring higher wages when their productivity is higher.

On the other hand, high land concentration can lead to higher labor absorption in the industrial sector. Industrial growth is dependent on an agricultural surplus for raw materials and food for the workers. High land concentration is beneficial for the agricultural surplus because more of the output reaches the market from large farms. If labor productivity is lower on small farms, the food surplus will be even lower in countries with low land concentration. Where land concentration is high, however, the landed elite can influence governments to hamper policies that could lead to industrial

growth (if the policies conflict with their interests). The industrial sector also depends on the agricultural sector as a market for their finished goods to finance the "imports" of raw materials and food from the agricultural sector. A policy encouraging low land concentration has the potential of expanding such a market. If this potential is to be realized, however, labor productivity on smallholdings must be high enough so that peasants can sell (at least) some of their output on the market (and get cash to buy the industrial goods). The relationship between land concentration and industrial growth is thereby somewhat contradictory: the supply of inputs for industries improves with high land concentration, while the demand for its products worsens (depending on how levels of labor productivity are affected by land concentration). Furthermore, as long as there is considerable unemployment in the agricultural sector, the supply of labor will be "unlimited", and industrial wages will probably not increase even if the industrial economy grows. On the other hand, the previously unemployed will have increased their income.

The degree to which income translates into entitlements to food depends on the entitlement mapping between income and food (or, in other words, the price of food). I have previously (in Section 2.5) argued that the price of food depends on the level of food availability per person. The price side of the entitlements to food is the focus of the following sub-section, where I discuss how land concentration influences food availability.

5.2.3 Land Concentration and Food Availability

Food availability refers to how much food is available per person in a country. The amount of food available for human consumption depends on the food supply, utilization, and the size of the population. On the supply side, food availability includes both domestic production and imports of food (including aid). The food supply is utilized for human consumption, exports, stocks, feed and seed (FAO 2002a). It is important to recall that developing countries have limited foreign exchange reserves, and that these reserves must cover the import needs of industry and consumers, in addition to the eventual imports of food. As food is something that can be produced with domestic resources and domestic technology, it is important for these countries to be as self-

sufficient as possible. In this way, limited foreign exchange can be used to import the high-tech machinery needed for industrial growth, but that cannot be produced domestically.

There are two main reasons that food availability influences food insecurity. The first is that there has to be enough food in a country to satisfy the nutritional requirements of the population. Among the poor, those who have access to land try to produce enough to meet their needs. The landless (whether working in the agricultural or the industrial sector of the economy) have to buy the food they need. Their food security depends on the price of food (in addition, of course, to their level of income, which we have already discussed). Thus, the second reason that food availability matters for food security is that, as discussed in Section 2.5, food prices are to a large degree dependent on the relationship between the supply of food, and its demand. If the demand for food is greater than the supply, food prices will tend to rise, because it takes a long time to expand food production (Kalecki 1971: 43-61).

We have already noted how land concentration affects the subsistence producers' ability to produce enough food for themselves. For this reason, the following discussion of food availability is concerned with the amount of food that is available on the market, for net buyers of food. It is for these people that food security depends on the price of food.

Land concentration affects food availability (on the market) through (at least) two possible channels: the type of crop that is produced, and labor productivity. In addition, land concentration influences the distribution of food between net-producers and net-buyers of food, through its effect on self-consumption in agriculture (see Figure 5.1.c). These issues constitute the focus of this section.

Messer and DeRose (1998) argue that land distribution influences how much food is grown in a country, relative to cash crops such as coffee or sugar. Owners of large farms tend to grow cash crops instead of food crops because they can earn more money from selling this on the world market. Using examples from Guatemala and El Salvador, they show that subsistence farmers were pushed off the most productive land to allow for larger holdings, aimed at coffee production. What determines the choice of

crops on large farms is the relative price of cash (versus food) crops, and commercial farmers seek to maximize their profits, not food security for the poor.

It may not be obvious, but smallholders are critical for the supply of staple food in developing countries. Table 5.1 shows the share of the total production of rice, wheat, and maize produced by smallholders in selected developing countries. Here we see that smallholders produce a large share of the food in these countries. In Burundi, for example, smallholders produce 95 percent of rice, maize and other food crops, even though they control only 52.2 percent of the cropland. In Ethiopia, smallholders produce 90 percent of all food crops, but hold only 28.4 percent of the cropland. In Ecuador,

Table 5.1: Share of Smallholder Farmers in Total Food Production in Selected Developing Countries, 1965-1988 (Percent)

Country	Rice	Wheat	Maize	Other Food Crops	Share of Cropland
Bangladesh	70	30	..	..	67.9
Burundi	95	..	95	95	52.2
Central African Republic	..	80	80	90	..
Congo	..	-	90	90	85.4
Ecuador	25	27	53	40	7.5
Ethiopia	-	90	90	90	28.4
Ghana	60	-	78	83	69.9
Guinea	89-90		80-90	80-90	95.1
Indonesia	75		75	90	72.0
Madagascar	70	..	60	90	62.4
Nigeria	90	..	90	90	70.9
Sierra Leone	61	-	..	63	10.9
Sri Lanka	45	-	45	..	40.7
Tanzania	..	..	80	80	..
Thailand	48	-	37	33	29.9
Zaire	60	..	48	60	49.9
Zambia	63	6	32	72	72.0 [a]

Notes: [a] indicates wetland; smallholders comprise all farmers operating less than three hectares of cropland; cropland is defined as "arable and permanent" cropland. Data that were not available are marked "…", while those that are not applicable are marked "-".

Source: Jazairy et al. (1992: 15)

smallholders hold only 7.5 percent of the cropland, but grow 25 percent of all rice, 27 percent of wheat, 53 percent of maize and 40 percent of other food crops.[16]

Part of the development debate argues that industrialized countries should open up domestic markets for food imports from developing countries. This, it is argued, will increase incomes among poor peasants in the South. This argument is problematic when we consider that most smallholder peasants are subsistence producers, and sell very little of their produce on the market. On the other hand, large farms (that are generally capital intensive and labor extensive) are the main producers for (international) markets. Thus, increasing exports would probably not raise the poor's incomes. Furthermore, encouraging exports could entice large farms to produce crops for export, instead of food for the domestic market (thereby contributing to lower food availability and raise food prices in developing countries).

In addition, subsistence farmers produce more plants (grain, roots, etc.) than animal products because they cannot afford to lose food value in the food chain. Large farms are freer to choose land-extensive animal production when market conditions are right. In short, low land concentration is expected to bring higher food availability because small farms produce food (at low levels of the food chain) while large farms have a tendency to grow (non-food) cash crops and animal products, when market conditions are conducive for such products.[17]

While large farms produce more cash crops and animal products that are higher up in the food chain (than small farms), the overall supply in the market will also depend on the labor productivity of those that produce food. Obviously, some large farms will produce food. Equally obvious is the fact that some subsistence producers will produce

[16] According to El-Ghonemy (1990: 32), the 1970 World Agricultural Census shows that it was smallholders with less than one hectare that grew most of the food grain in developing countries (at that time). In particular, these smallholders grew 74 percent of all harvested wheat, 68 percent of the rice, and 60 percent of the maize.

[17] Of course, much of the developing world's foreign exchange is earned by exporting agricultural goods, because these countries have little, and often uncompetitive, industry. This is a dilemma, because if the agricultural sector produces export crops instead of staple food for the country's poor, domestic food security may be compromised (at least) in the short run. In the long term, food security may improve (by way of "trickle-down" effects) if the industrial sector grows and people's income (and import capacity) increases. However, it is problematic to postpone people's food security for years or decades.

some excess for the market. Indeed, in most cases it is reasonable to expect that subsistence farmers will try to produce more food than they need, so that they can sell or trade. But, it is important to note that they will only (voluntarily) sell some of their output when they have first satisfied their own need for food.

Brenner (1997) argues that peasants in late medieval and early modern Europe had a "safety first" attitude which made them choose to diversify production for subsistence instead of specializing production and exploiting the gains from trade. To engage in the market meant that they had to compete with other producers. This competition leads to a never-ending search for (and application of) improved inputs and technology. Such competition makes them depend on the market for inputs and technology, as well as for the income they need to buy food. Since the price of both inputs and food can vary considerably, peasants that depended on the market ran a higher risk of income failure and starvation. This is not unlike the situation facing many smallholders in developing countries today. Thus, it is not unreasonable for them, out of "safety first" concerns, to diversify their production for subsistence, even if their labor productivity may be higher if they specialize production and engage in trade. Subsistence producers can market a surplus in good years, but in bad years they are "free" to consume all that they can produce.

Table 5.2 provides data on the marketed share of smallholder farmers' food production in (selected) developing countries. It shows that smallholders generally market only 10-20 percent of what they produce. To this rule there are exceptions. In Bangladesh, smallholder farmers market 80 percent of their maize production and 60 percent of the wheat and other food crops (but only 20 percent of rice, which is the most important staple food in that country). In Pakistan, smallholders market 90 percent of food crops other than rice, wheat and maize (of which they only market 20 percent of each crop).

While we do not have any data for the marketed share of the output on large farms, it is reasonable to believe that they market close to 100 percent of what they produce. The marketed share of domestically produced food will thus be lower in countries with an agrarian structure dominated by small farms, than in countries where land is concentrated into large holdings.

Table 5.2: The Marketed Share of Food Production among Smallholder Farmers in Selected Developing Countries (Percent of Output)

Country	Rice	Wheat	Maize	Other Food Crops
Bangladesh	20	60	80	60
Bolivia	30	10	10	50-80
Ecuador	5-10	5-10	5-10	5-10
Ethiopia	-	18	18	18
Indonesia	10	-	10	10
Madagascar	10	-	-	10
Mexico	10-15	10-15	10-15	10-15
Pakistan	20	20	20	90
Peru	-	30-35	30-35	30-35
Sri Lanka	15-20	-	15-20	-
Tanzania			25	25
Zambia	100	-	30	10-15

Note: Marketed share includes cash sales and barter transactions (both through official and private channels). Data are of mixed quality and should be treated with caution (Jazairy et al. 1992: 468).
Source: Jazairy et al. (1992: 412-13)

An example from the Chinese (collectivization) land reform in the 1950s supports the argument that a lower share of the food output reaches the market when access to land is distributed more equally. From Table 5.3 we can see that grain production increased in China during the height of the collectivization process. Nevertheless, the surplus of grain available for the urban sector declined.[18]

Table 5.3: Surplus of Grain Available for Urban Areas in China, 1954/55-1956/57 (Millions of tons)

	1954/55	*1955/56*	*1956/57*
Total grain output	169.5	183.9	192.7
Total collections and purchases	53.9	52.0	49.9
Re-sales to rural areas	24.7	20.2	24.5
Available for urban consumption, exports and government stockpiles	29.2	31.8	25.2

Source: Eckstein (1966: 312)

Thus, we can expect that countries with many small farms will have a high share of subsistence production. Since lower land concentration most likely means smaller

[18] The urban sector does not necessarily coincide with the non-agricultural sector, because there may be some agricultural activity in urban areas and some industrial activity in rural areas.

farms and more subsistence production, self-consumption will probably be higher (and the marketed share of output lower) where land is equally distributed.

The peasant's labor productivity also determines whether a high share of subsistence producers means low food availability (on the market). According to Lippit (1978: 58) and Barraclough (1991: 129), income elasticity for food is high where consumption is very low (and relatively low where consumption is high). Consequently, it is likely that smallholders/subsistence farmers who (in many cases) are living near subsistence levels will increase their consumption of agricultural products if their labor productivity increases. The elasticity of the food surplus with regard to growth in food production may therefore be negative in the early stages of development. The income elasticity of self-consumption in agriculture will most likely decline at higher levels of agricultural labor productivity (Skarstein 1997: 111-112).

However, smallholders can only choose to consume all of their output in so far as they are owner-cultivators. Tenants must produce a surplus in order to pay the rent to their landlord. The marketed share of food production will therefore be higher where peasants are mostly tenants and not free-holders.

In *Conditions of Agricultural Growth,* Boserup (1965) argues that farmers in "primitive" societies only increase land productivity in order to avoid a reduction in the level of food consumption. She argues that: "the effort devoted to food production Ψin primitive societiesβis often seen to be limited to the bare minimum of hours in order to avoid starvation. This attitude may help explain why, in communities with a system of long fallow and with abundant land and little input of agricultural labor, the cultivated area is often barely sufficient to give a crop which can last until the following harvest" (Boserup 1965: 54). She explains this activity in terms of the high value these people put on leisure time (compared to increased consumption). The implication of this theory is that a food surplus will not be generated because cultivators will only produce enough to (barely) feed themselves and their families. Boserup further assumes that these "primitive" people will reduce their leisure time and work more "…only under the compulsion of increasing population or under the compulsion of a social hierarchy" (1965: 54).

I do not mean to suggest that low labor productivity in developing country agriculture today is due to peasants prioritizing leisure over (hard) work. The point I want to make is that where land is distributed into many small owner-cultivated farms—and peasants are not compelled to generate a surplus to pay rent on their land—the surplus of food available for the net-buyers of food will most likely be lower than if the small holders were tenants**.**

In neo-classical economics it is held that the agricultural surplus will grow if food prices are high (relative to prices on industrial goods), because this will provide farmers with incentives to decrease the share of their output that they retain for self-consumption (and increase their total output). If food prices are low, farmers do not have an incentive to sell more of their output on the market, because they have to sell too much in order to afford too few industrial products.[19] Bhaduri (2003: 5-6) has explained how, from a neo-classical perspective, the favorable terms of trade for agricultural products will influence the food surplus:

> "Not only might a higher agricultural price provide stronger incentive to increase agricultural output in the manner taught usually by textbooks (although empirical evidence on this point is ambiguous in developing countries) but more interestingly, the availability of industrial goods as well as its relative price in terms of agricultural goods might also influence the amount that farmers decide to retain for self-consumption."

There are several problems associated with this liberalization-strategy for increasing the food surplus. First of all, food insecurity among the poor net-buyers of food will increase when prices are allowed to rise. If this were only a short-term effect, and if the food surplus were soon to rise and lead to lower prices and better food security in the long run, the problem would not be so severe. But, there are several reasons to believe that the expected increase in the food surplus will fail to materialize. The first is, as argued by Bhaduri (2003: 8-9), a consequence of the (different) ways that prices are formed in agriculture and industry. In agriculture, prices are formed after supplies arrive

[19] It is further believed that governments should not intervene in the price determination (but only ensure the conditions for a free market), because this free market will ensure the "right" price for food. When the food surplus is too small, there will be food shortages, and prices will rise. Farmers will then invest in new technology, and/or more land in order to increase their (marketed) production. When the surplus is too large, there will be insufficient demand, prices will fall, and farmers will reduce their production to avoid losses.

on the market, in response to demand, which means that they are largely demand-determined. Industrial prices, on the other hand, tend to be cost-determined because they are set prior to sale, and variations in demand are usually dealt with through changes in inventory or the volume of production. As we have already discussed, it takes a long time before increases in demand for agricultural products (food) translates into increased production (Kalecki 1971). When we combine this observation with Kaldor's (1978: 207) argument that "the price of labor in terms of food cannot fall below a certain minimum determined by the cost of subsistence, whether that cost is determined by custom or convention or by sheer biological needs", we begin to understand why the favorable terms of trade (in the eyes of the agricultural sector) is short lived. This chain of reasoning is simple and strong: 1) higher prices of food will be met by higher wage claims; 2) higher wages will be met by higher prices on industrial goods; and 3) the price of food will no longer be high in relation to industrial goods. Thus, only food price inflation (and subsequently general inflation) is produced (Bhaduri 2003).[20]

This section has looked into three main links between land concentration and levels of food availability: type of crops, labor productivity and self-consumption. Large farms probably produce more cash crops (in relation to food crops) and animal products than small farms. By means of this mechanism, high land concentration will lead to lower food availability. On the other hand, nearly everything that is produced on these farms reaches the market, while small farms market less, if anything at all (depending on their labor productivity). This link counteracts the (possible) negative effect of high land concentration for food availability from more cash crops and animal products on large farms. Thus, there is no clear-cut relationship between land concentration and food availability. Finally, it is still unclear whether large and small farms differ with respect to levels of labor productivity. This is the focus of the next section.

[20] However, for subsistence producers that produce a surplus for the market, higher food prices may translate into higher incomes. As these peasants do not depend on the market for their access to food, higher food prices may give them the possibility to invest in inputs to improve their labor productivity, and thereby their food security.

5.3 Land Concentration and Labor Productivity in Agriculture

Throughout this chapter it has become clear that agricultural labor productivity is an important factor for explaining food insecurity in developing countries. The purpose of this section is to explain how land concentration influences labor productivity in agriculture.

We can briefly recall from the previous two sections that labor productivity in agriculture influences food insecurity in the following manner:

1) High agricultural labor productivity is important for *direct* entitlements to food for subsistence producers because it determines whether or not peasants can produce enough food to keep themselves (and their families) food-secure.
2) High agricultural labor productivity influences indirect entitlements to food through the *income* of landless *agricultural* workers, to the degree that their wages increase when they can produce more.
3) High agricultural productivity influences indirect entitlements to food through the *income* for the (landless) *industrial* workers because growth in the agricultural surplus is beneficial for industrial growth. This relationship lies in the fact that the agricultural surplus provides food and raw materials for industrial input, as well as effective demand for industrial products; and the level of the food surplus is influenced by agricultural labor productivity. Industrial workers benefit to the degree that their wages increase when the (industrial) economy grows.
4) Insofar as high agricultural labor productivity stimulates industrial growth, it may also increase labor absorption in industry, and decrease the number of landless agricultural workers. Landless laborers in agriculture become more powerful in their relation to landowners, raising wages.
5) High agricultural labor productivity influences the level of food availability (per capita) in the country, and consequently the *price* of food for the net-buyers of food.

In this way, labor productivity in agriculture influences food security via both entitlement relations and food availability relations, and represents a bridging force between entitlements to food and food availability.

In the following section I discuss the relationship between land concentration and labor productivity in agriculture. This discussion has two parts. In the first part (Sub-Section 5.3.1), I explain why I approach the discussion of agricultural labor productivity through the channels of land productivity and the amount of arable land per worker (or, in other words the land/labor ratio). In Sub-Section 5.3.2, I discuss how land concentration affects agricultural labor productivity through these channels.

5.3.1 Land Productivity, the Land/Labor Ratio, and Labor Productivity in Agriculture

In this section I explain the relationship between land productivity, the land/labor ratio, and labor productivity in agriculture. It is important to recognize this relationship because we will subsequently (in Sub-Section 5.3.2) discuss how land concentration affects agricultural labor productivity, via the channels of land productivity and the land/labor ratio.

Timmer (1988: 304) elegantly describes the relationship between the land/labor ratio, land productivity and labor productivity in agriculture:

> "Productivity in agriculture is traditionally measured in one of two ways: in output per hectare, or output per agricultural worker. Despite the focus by agricultural scientists on the former measure, from a welfare perspective the latter measure is clearly the relevant one. Output per hectare is important only as a vehicle for raising output per worker. In land scarce environments facing rapid population growth and limited absorption of labor by industry, of course, raising output per hectare may be the *only* way to raise labor productivity."

In extending this discussion, Timmer (ibid: 303-304) distinguishes between technology that raises land productivity, and technology that increases the land/labor ratio. The first type of technology consists of biological and chemical innovations such as (chemical) fertilizers, pesticides, and hybrid seeds. The second type is composed of mechanical innovations, such as tractors and other machinery, that make agricultural work easier

and reduces the need for labor (per unit of output and per unit of cultivated land). This machinery can also increase land productivity, but is mostly designed to save labor.

The relationship between agricultural labor productivity, land productivity and the land/labor ratio can be expressed by the following identity:

$$Y/L \text{ ƒ } (Y/A) \bullet (A/L), \tag{5.1}$$

where Y represents value added in agriculture, L represents the labor force, and A represents the amount of cultivated land. Thus, Y/L symbolizes agricultural labor productivity, Y/A captures land productivity, and A/L represents the land/labor ratio. From this identity we can see that an increase in labor productivity can result from higher land productivity (Y/A) and/or a higher land/labor ratio (A/L) (Hayami and Ruttan 1985: 119).

Since the product of two numbers on a natural scale is the same as the sum of two numbers on a logarithmic scale, the identity can also be expressed as:

$$\log (Y/L) \text{ ƒ } \log (Y/A) + \log (A/L). \tag{5.2}$$

This identity is the basis for Figure 5.2, which visualizes how different combinations of labor-saving and/or land-saving developments in agriculture affect land and labor productivity, respectively.

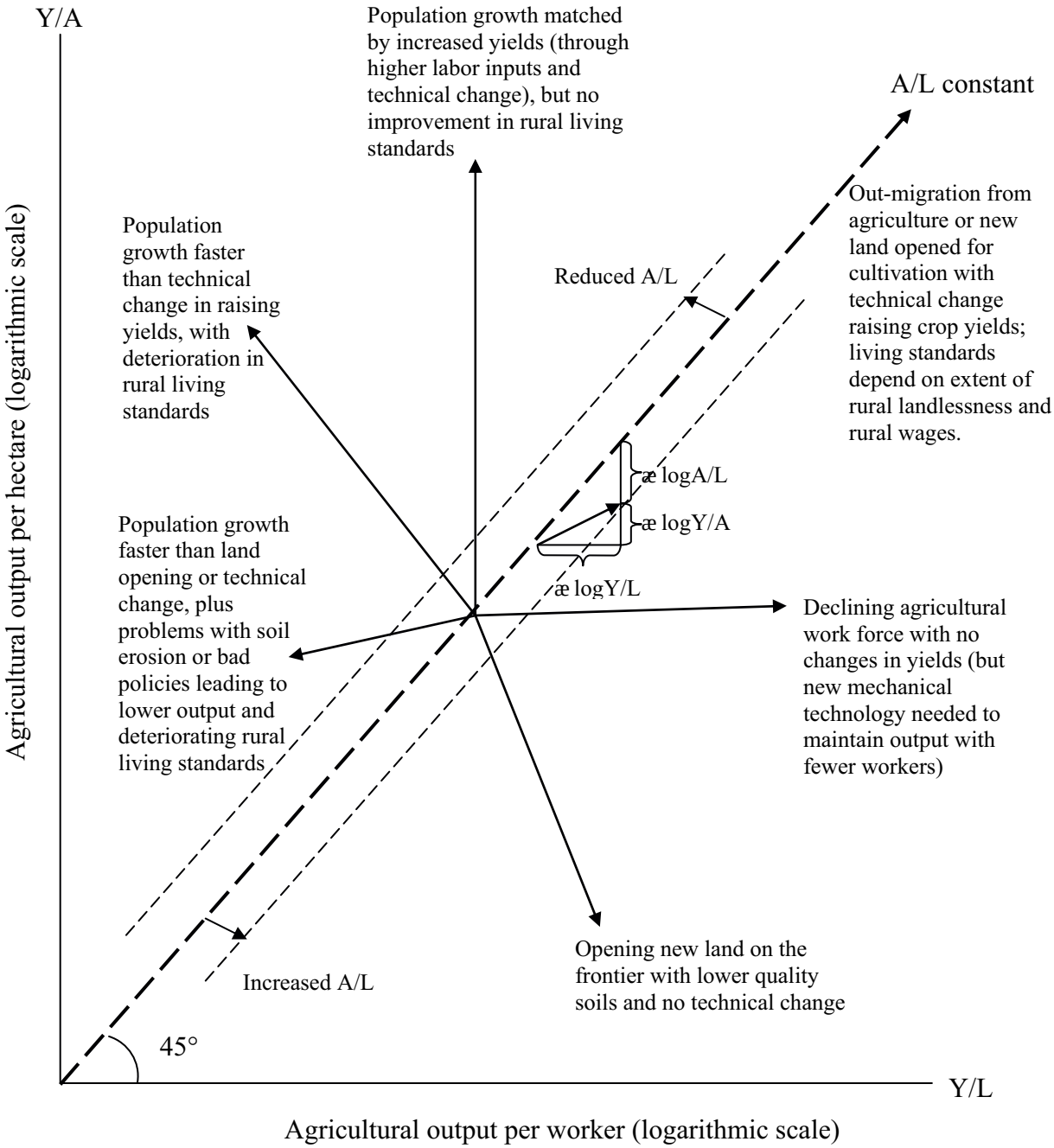
The 45∀line in the figure reflects a constant land/labor ratio. The short arrow at the center of the figure illustrates a fictitious country's path to higher labor productivity. For this country, higher agricultural labor productivity is achieved partly through raised land productivity, and partly through an increase in the land/labor ratio. We can see from the figure that

$$æ \log (Y/L) \text{ ƒ } æ \log (Y/A) + æ \log (A/L), \tag{5.3}$$

where the relative contribution of the increase in the land/labor ratio is shown as æ log (A/L), the relative contribution of the rise in land productivity as æ log (Y/A), and the total increase in agricultural labor productivity is shown as æ log (Y/L).

Only movements to the right—that mirror higher output per agricultural worker—can possibly help to improve worker welfare (depending on the distribution of the output between labor and landowners). Movements along the 45∀line mean that the land/labor ratio remains constant and that increased labor productivity results from increases in land productivity alone. A straight movement to the right implies no change

Figure 5.2: Classification of Changes in Agricultural Productivity



Note: The vertical axis is crop yields per hectare, and the horizontal axis is agricultural output per worker (both on an logarithmic scale), the agricultural workforce is measured as the entire economically active population in agriculture.

Source: This is a modified version of a figure adapted from Timmer (1988: 305)

in land productivity, a decline in the agricultural workforce per hectare, and a simultaneous increase in the use of labor saving technology to keep the production levels up with fewer workers. This is only probable in situations where idle land can be colonized. It further requires that new land can be brought under cultivation faster than the population grows. It is an unlikely path in today's developing countries, where reserves of land are small (with the exception of some countries in Latin America) and the population is growing rapidly. Today's developing countries are more likely to experience movements in three different directions. First, movements might go straight up (increased land productivity but not labor productivity). This option is sometimes referred to as "running fast technologically to stand still economically". The second option is upward to the left. Here the increase in land productivity is eaten up by an increase in the labor force, with reduced labor productivity as the result. In the third and worst case, the movement can be downward and to the left. This means that both land productivity and the land/labor ratio decreases, leading to a decrease in labor productivity. This path can arise in situations of rapid population growth and deteriorating soil quality, due to, for instance, over-intensive production (Timmer 1988: 304-306).

Timmer (1988: 310) uses data from Hayami and Ruttan (1985) to show that economies of scale explain about 25 percent of the lower labor productivity in India, the Philippines, and Peru (in 1960 and 1980) compared to the United States. The remaining three fourths of the labor productivity difference is (equally) accounted for by different endowments of: 1) internal resources, such as land and livestock; 2) technical inputs, such as fertilizers and machinery; and 3) human capital, such as general and technical education. Timmer concludes that developing countries have the potential to increase their labor productivity in agriculture through increased land productivity—in spite of a declining land/labor ratio (1988: 310). Hayami and Ruttan conclude (from the same data) that: "it is especially encouraging to find that the agricultural production function in LDCs are neutral with respect to scale" (Hayami and Ruttan 1985: 157). Thus, their conclusion is that farms do not have to be large in order to achieve high levels of labor productivity. If the small farms could get access to the same "internal resources,

technical inputs and human capital" that is available to the large farms, labor productivity levels would be almost as high as on large farms.

In my opinion, there are two problems with Hayami and Ruttan's conclusion. First, I would not have argued that "the agricultural production function is neutral with respect to scale", when it (according to their analysis) account for as much as 25 percent of the difference in labor productivity between the three developing countries and the Unites States. Second, it is not as simple as it sounds for small farms in developing countries to raise their labor productivity by obtaining access to the same "internal resources, technical inputs and human capital" as they have on the large farms in the United States (or in their own country). After all, the problem is often that small farms in developing countries do not have access to these inputs. This raises the crucial question of whether it is possible for smallholders in the developing countries to improve their labor productivity. This is the focus of the next sub-section.

5.3.2 Land Concentration and Agricultural Labor Productivity

Neo-classical economics has dominated much of the thinking about agricultural development policies for several decades. Within this approach it is believed that price incentives are the best means for increasing productivity in agriculture. There are, however, alternative approaches to explaining agricultural labor productivity. This section will trace some grounds for pessimism about the effect of liberalization on agricultural labor productivity. For example, in his empirical study of 20 Indian districts, Schäfer (1997) finds that aggregate agricultural production is largely unresponsive to prices, and that growth in agricultural production is highly dependent on infrastructure (such as length of roads, degree of irrigation and number of markets). Schäfer also reviews a number of other studies on the price responsiveness of the aggregate agricultural supply. He concludes that: "The results, so far, do not lead to elasticity optimism" (1997: 102).

Binswanger (1995) argues that even though the price elasticity of supply of individual crops (or small groups of crops) is high, the price elasticity of the total agricultural production is very low in the short run because the factors of production—land, capital and labor—are fixed (in the short run). A farmer can shift resources from

one crop to another without raising the total output. Thus, growth in one crop takes resources away from other crops, but growth in aggregate production fails to appear. In the long run, agricultural production is responsive to prices, but the process will take from ten to twenty years, and only if more resources are devoted to agriculture.

Thus, it is unlikely that the roots of low labor productivity are found in agricultural price distortions. It is more probable that the roots lie in institutions within the agricultural sector, and how these affect power relations between smallholders, owners of large estates, the landless and the government.

Land concentration is at the center of these issues, as it materializes in the size and distribution of farms, which coincides with the distribution of economic and political power, and unequal possibilities to attain the resources necessary to increase productivity.[21]

In the remaining part of this section I will discuss how land concentration affects land productivity and the land/labor ratio—and thereby agricultural labor productivity. In this discussion I will use the identity $Y/L \sum(Y/A) \bullet (A/L)$ (Identity 5.1, as explained above), as a guiding principle.

I will first discuss theories about how land concentration affects land productivity, where there appears to be little consensus. Theories about the relationship between land concentration and the land/labor ratio are more uniform, arguing that small farms have lower land-labor ratios than large farms. The relationship between land concentration and the land/labor ratio will enter into the discussion as we begin to see that much of the variation in land productivity is due to variations in labor intensity. Last, but not least, I will discuss how the interaction between land productivity and the land/labor ratio affects labor productivity on large versus small farms.

There is disagreement about whether land productivity is higher on large or small farms. On the one hand, it is possible to find arguments that large farms have

[21] This does not always have to be true, as the size of farms depends on how much land is available per person, and how it is distributed. However, for the sake of analytical parsimony I will assume that high land concentration is associated with large farms, and low land concentration with small farms.

higher land productivity than small farms. These arguments explain the higher land productivity of large farms in terms of:[22]

a) better educated managers;
b) a division of labor and specialization, and also that;
c) larger farms can generate more revenues, have better access to credit, and can therefore invest in more inputs such as irrigation, and fertilizers.

On the other hand, there is "The Inverse Relationship Theory", which argues that land productivity is higher on small farms. This perspective can be traced back to Adam Smith's (1776) legendary *The Wealth of Nations*. By comparing the conditions of large estates with smallholdings in their neighborhood, Smith argued that small farms enjoyed higher land productivity because they were more adaptive to new technology (Smith, cited in El-Ghonemy 1990: 133). He claimed that "great proprietors were seldom great improvers, because their style of life (dresses, staff, house, etc.) constituted a state of mind and habit that led to the neglect of their vast estates" (ibid.: 137).

Since Adam Smith, much has been written on the subject. There is a whole range of studies that support an inverse relationship between farm size and land productivity. Among these studies different causal explanations may be found. The most common of these are that:[23]

a) a larger part of the holdings are in productive use on small farms than on large farms;
b) small farms plant more crops per year than large farms;
c) small farms plant higher value crops, while large farms are often engaged in land extensive production (such as livestock);
d) large landowners often invest in land for other reasons than to use it as a productive resource (such as for social prestige and political power, or as a "portfolio" investment in periods with high inflation);

[22] See for example Ellis (1988: 194-195); El-Ghonemy (1990: 123), and Patnaik (1972).

[23] Bharadwaj (1974: 11-31); Ellis (1988: 198-199); El-Ghonemy (1990: 128-132); Tyler et al. (1993); Thiesenhusen (1995: 10); and Boserup (1965).

e) small farms are often family run, so they enjoy more flexibility with regard to seasonal employment; and
f) labor intensity is higher on small farms.

This last point, about higher labor intensity on smaller farms, brings us to the heart of the relationship between land and labor productivity, namely the land/labor ratio. Boserup (1965) argues that population growth (and thereby a decrease in the land-labor ratio), is the most important explanatory factor for growth in land productivity. When the population increases, agricultural land will have to be used more intensively in order to increase land productivity sufficiently to feed the additional people.[24] More intensive use of the land means shorter fallow periods and a higher input of labor. Multi-cropping requires more man-hours per hectare because there is less seasonal unemployment and the land has to be ploughed and fertilized (and sometimes irrigated) in order to bear crops more often. She writes:

> "As long as the population of a given area is very sparse, food can be produced with little input of labor per unit of output and virtually no capital investment, since a very long fallow period helps to preserve soil fertility. As the density of the population in the area increases, the fertility of the soil can no longer be preserved by means of long fallow and it becomes necessary to introduce other systems which require a much larger agricultural labor force. By the gradual change from systems where each cultivated plot is matched by twenty similar plots under fallow to systems where no fallow is necessary, the population within a given area can double several times without having to face starvation or lack of employment opportunities in agriculture…[T]he complex changes which are taking place when primitive communities change over to a system of shorter fallow are more likely to raise labor costs per unit of output than to reduce them" (Boserup 1965: 117).

From this we can conclude that Boserup means that a decrease in the land-labor ratio will probably lead to an increase in land productivity, but decrease (or stabilize) labor productivity. This implies that small farms may have higher land productivity

[24] She assumes all land as cultivated, while some of the cultivated land is only used once in a generation (or more) while other land is used every year, or even several times a year (land is replanted right after the previous crop is harvested). A reduction in fallow periods is thus interpreted as an intensification of land use. Along with the reduction of fallow time comes technological change, because different tools are needed to cultivate land with short or no fallow systems (than land that is under long fallow systems).

levels than larger farms, because they employ labor more intensely. However, labor productivity levels will probably not be higher, because of the lower land/labor ratio (resulting from high input of labor).

On the other hand, Dyer's (1991, 1997 and 1998) studies of land productivity on Egyptian farms conclude that while there might have been an inverse relationship between farm size and land productivity before the Green Revolution, this relationship has broken down. Today's large farms can generate the capital needed to keep up with technological developments. Since smallholders often do not have enough land (or inputs) to make a "decent" living, the inverse relationship is a result of desperate families fighting for survival on too small pieces of land. By trying to scratch a living from inadequate holdings of land, family farms use the land much more intensively than their larger counterparts. Over time, such intensive farming will degrade the quality of the soil and give rise to even greater hardships. According to Dyer, "the inverse relationship is not a product of superior efficiency on the part of small farms nor is it due to better quality land on the small farms" (1997: 146) but "...arises from the desperate struggle of poor peasants for survival on below subsistence plots of land...Ψand theβ..redistribution of land on the basis of the inverse relation argument therefore, far from alleviating poverty and creating employment opportunities, will only deepen and perpetuate extreme levels of exploitation and poverty" (1998: 146 and 1991: 87).

Havnevik and Skarstein (1997) have also found evidence that small farms in Tanzania use their land more intensively than large farms. They reveal that while farms with more than 4 hectares plant less than 50 percent of their agricultural area (which means that they leave the other 50 percent fallow), and the farms of 0.5 to 2 hectares plant 75 percent, the farms of 0.5 hectares or less plant as much as 90 percent of their holdings. They argue that the higher intensity of land-use on the small farms is due to a struggle for survival in the same fashion as Dyer argues above:

> "It seems to us that the smallest holdings of less than 2 ha in Tanzania have been caught in a combined productivity and sustainability trap. They have too little resources to practice intensive agriculture with the necessary soil preserving practices, at the same time as they have too little land to maintain long enough fallow periods from a sustainability point of view. If this dilemma is not overcome, then overall productivity of Tanzanian agriculture will continue to decline" (Havnevik and Skarstein 1997: 200).

Dyer, as well as Havnevik and Skarstein, takes Boserup's argument one step further. From Boserup's thesis (that lower land-labor ratio spurs higher land productivity, primarily by way of more labor intensity), they argue that this labor intensification is unsustainable and will lead to low land productivity in the long run, because the quality of the soil is degraded. This extra step is what separates Boserup's theory from the neo-Malthusian theory of population (where, as discussed in Chapter 2, population growth leads to over intensive land-use, reduced land productivity, and thereby reduced human carrying capacity). Boserup is aware of this link between intensive land-use and higher land productivity in the short run, to over-intensive land-use and lower land productivity in the longer run. Nevertheless, she argues that neo-Malthusians "neglect the evidence we have of growing populations which managed to change their methods of production in such a way as to preserve and improve the fertility of their land" (1965: 22). According to Havnevik and Skarstein, the problem is that the poorest peasants cannot take advantage of improved technology because they are too poor to afford it. Their land is simply too small for them to produce a surplus that can be used to acquire costly inputs. Thus the productivity of their land will fall as it is deprived of the nourishment it needs to sustain it.

Bhaduri (1997: 122) also argues that labor productivity is lower on small, family operated, farms because the labor intensity is higher than on large farms. He explains the higher labor intensity on small farms in terms of standard economic analysis: since there is a relative scarcity of land compared to family labor, the opportunity cost of family labor is zero. Therefore, family farms will use labor more and more intensively until the marginal product of labor becomes practically zero. On larger farms, in contrast, additional labor would only be put into production as long as the marginal product of labor is not lower than the given real wage-rate. Consequently, smaller farms have higher yields (per unit of land) and lower labor productivity.

To sum up, there seems to be a consensus that smaller farms have a lower land/labor ratio than large farms. In contrast, the relationship between land concentration and land productivity is unclear: there are studies that support "the inverse relationship theory" between farm size and land productivity, and there are studies that denounce it. However, the work of Dyer (1991, 1997 and 1998) and Havnevik and Skarstein (1997)

lead us to expect that small farms may enjoy higher land productivity in the short run, but that the low (and decreasing) land/labor ratio on these farms will lead to a fall in land productivity over the long run. This long-term drop in land productivity results from over-intensive cultivation of the land in order to maintain labor productivity when more and more people need to survive on the same small area of farmland. Since they do not have the resources to invest in preserving the land's fertility, it will eventually become exhausted and land productivity will drop.

Thus, the relationship between farms size and land productivity is critical. If small farms, in combination with their lower land-labor ratio, also suffer from lower land productivity, an agrarian structure with many small farms (low land concentration) will be unfavorable for labor productivity in agriculture, and thereby for food security. However, if small farms have higher land productivity, there is a chance that also labor productivity could be higher on small farms.

5.4 Summary

In this chapter I have provided a conceptual scheme for the relationship between land concentration and food insecurity. I have discussed the dynamics through which land concentration affects the direct entitlements of subsistence producers, and the indirect entitlements of landless, agricultural and industrial workers. For the latter groups, who are net-buyers of food, I have elucidated how land concentration affects both the income and the food price side of the food security equation. Finally, I discussed the relationship between land concentration and labor productivity in agriculture. Because of the complexity of these relationships, I began with a schematic depiction (in Figures 5.1a to 5.1c), and followed with a detailed examination of the various causal linkages.

When land concentration is high, fewer people are subsistence producers. For the peasants that do have access to land, the holdings will be small (and the land/labor ratio will be low on these farms), and tenancy terms will probably be harsher (for those that rent land). It also appears that high land concentration hurts landless agricultural workers. Labor absorption rates are relatively low on large farms, so many landless workers will be underemployed. In addition, these workers have little power to command decent wages. For these reasons, incomes among the landless agricultural

workers are expected to be low when land concentration is high. Thus, for the agricultural population as a whole, it is most probable that high land concentration leads to high food insecurity.

However, high land concentration can be beneficial for the food security of workers in the industrial sector, because the agricultural surplus will probably be high. High agricultural surplus benefits industrial growth, as it can increase labor absorption levels and thereby the incomes of the poor. Higher labor absorption in industry can reduce unemployment among the landless agricultural workers, and possibly increase the power of the agricultural workers in their relations with landowners. This may eventually improve the incomes of both groups.

It is important to recall that the incomes of agricultural and industrial workers must be seen in relation to food prices. It is this relationship that determines food insecurity. Land concentration influences food prices through food availability. When land concentration is high, and the average size of farms is large, cash crops will probably constitute a higher share of the total agricultural production. On the other hand, self-consumption is lower on large farms. The effect of agricultural labor productivity further complicates the picture, as it is unclear if large farms have higher (or lower) labor productivity. It is probable, however, that labor productivity is higher on large farms, and thus higher where land concentration is high. If food availability is higher when land concentration is high, it will mitigate the negative effects from low incomes on the food insecurity of landless agricultural workers. It will further strengthen the constructive effect on food insecurity from high incomes among the industrial workers.

The conceptual scheme in this chapter has uncovered that the relationship between land concentration and food insecurity is complex and contradictory. However, there is one simplifying cleavage that springs out of this discussion. If we look at subsistence producers and agricultural workers (the two main groups that depend directly on agriculture for a living), we see that land concentration affects these two groups in the same general way: high land concentration (probably) leads to high food insecurity in both groups. On the other hand, land concentration affects the food insecurity of industrial workers in the opposite direction: high land concentration will likely produce low food insecurity in this group. The discussion of the conceptual

scheme might be summarized thus: high land concentration affects the agricultural population differently from the non-agricultural population.

Consequently, there are two reasons why we may get *low* food insecurity in the *total* population when high land concentration is combined with a low share of agricultural population.[25] First, the agricultural population, which suffers high food insecurity when land concentration is high, constitutes a small share of the total population. Second, the non-agricultural population, that enjoys low food insecurity when land concentration is high, constitutes a large share of the total population. On the other hand, we may get *high* food insecurity in the *total* population when high land concentration is combined with a large share of agricultural population.

In Chapter 7 I will test how land concentration affects food insecurity via the channels described in this conceptual scheme. However, the unavailability of data makes it unfeasible to test all the causal links that we have discussed. Therefore, the model I test will be a simplified version of the conceptual scheme. Before we can employ this statistical test, I need to build a viable model that preserves as much of the complexity as possible. This transition from conceptual scheme to testable model builds on the simplifying cleavage that land concentration affects the agricultural population and the non-agricultural population differently. Constructing this model is one of the objectives of Chapter 6.

[25] Henceforth I will use "the share of agricultural population (in total population)", "the share of the population that depends on agriculture for a living", and the "the share of the agricultural population" interchangeably.

6

Setting up the Test

In the previous chapter I discussed how land concentration affects food insecurity for subsistence producers and landless workers in agriculture and industry. The outline of this discussion was the conceptual scheme presented in Figures 5.1.a and 5.1.b and 5.1.c. In order to move from explaining the theoretical relationship to investigating the empirical relationship, we need to press the conceptual scheme into a model, which can be tested on a sample of developing countries.

This model needs to be sensitive to the fact that data are not available for several of the variables considered in the conceptual scheme. The challenge of this chapter is to preserve as much as possible of the conceptual scheme's explanatory richness, while developing a testable model that captures the complexity of the relationship between land concentration and food insecurity.

This chapter has three sections and a summary. In Section 6.1, I present a testable model based on the previous chapter's conceptual scheme. This model includes both direct and indirect relationships with food insecurity. In Section 6.2 I discuss the indicators used to test this model. In Section 6.3, I begin the empirical test with simple bivariate correlations between food insecurity and the variables in the model, and Section 6.4 summarizes. (I perform a multivariate regression analysis of the model in Chapter 7.)

6.1 From Conceptual Scheme to Testable Model

Modeling always expresses a tension between parsimony and explanatory richness. In the previous chapter I chiseled out a conceptual scheme for explaining the various direct and indirect ways that land concentration affects food insecurity in developing countries. As such, the conceptual scheme has a value in itself: it fills a gap in the existing and separate literatures of food insecurity and land concentration. Part of the purpose of this thesis is to show that the relationship between land concentration and food insecurity is more complex and contradictory than is commonly perceived. For this reason, I have used the conceptual scheme to prioritize explanatory richness over parsimony. In a world of unlimited access to ideal data, I would test all of the

relationships in the conceptual scheme. Unfortunately, I do not have data to test all of these relationships.[1] Consequently, a complex model that is directly derived from the conceptual scheme cannot be tested. As a result, I will have to simplify the model in order to test it.

The first, and perhaps the most restrictive problem, is that we lack data on food security among the three different groups of people in the conceptual scheme: subsistence producers, landless agricultural workers, and landless industrial workers. As discussed in Chapter 3, the best available data on food insecurity measure the prevalence of stunting in children under five. These data are not specified across producer groups (e.g., subsistence producers, landless agricultural workers, and landless industrial workers). They only appear as percentages of children under five in the total population. This makes it impossible to study the direct entitlements of subsistence producers separately from the landless agricultural and industrial workers.[2] For this reason I must test the empirical relationship between land concentration and food security in the total population.

Although the problem of inadequate data forces me to employ a model that is less complex than originally conceived, there are certain possibilities embedded in the available data that compensate for some of these limitations. When we measure the effect of land concentration in relation to food insecurity in the total population, we lose sight of the effects on different groups. Thus, the total population's level of food insecurity will lie somewhere in between the food insecurity level of subsistence producers, agricultural workers, and industrial workers, according to the relative size of the different groups.

One lesson from Chapter 5 will be central to the explanatory power of the new model. As described in the summary of that chapter, the conceptual scheme

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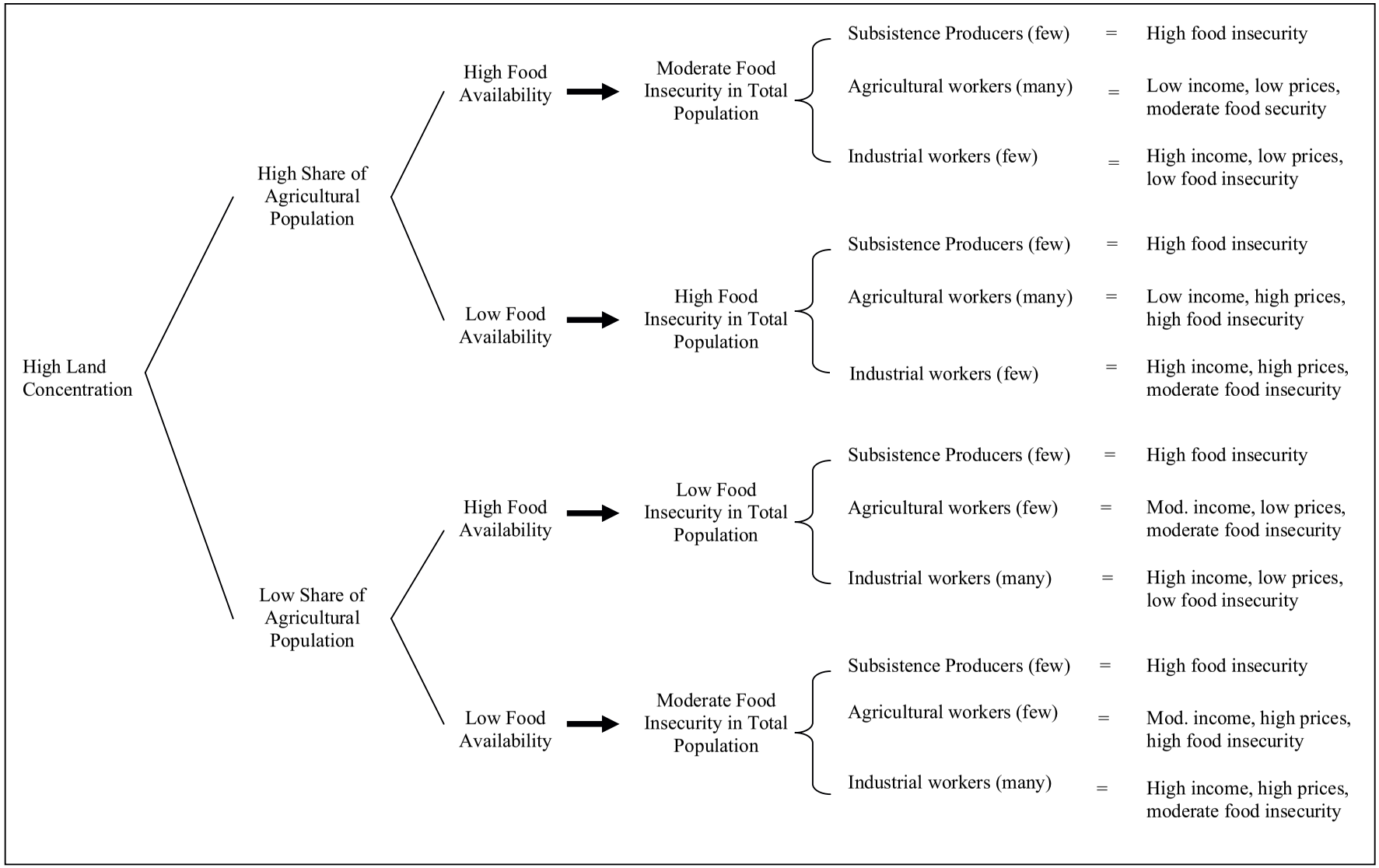
[1] Since data on land concentration is only available for 41 developing countries, any test of a complete model would quickly run into degrees-of-freedom problems.

[2] Some countries have data on stunting that are split into urban and rural populations. Although these groups do not overlap completely with subsistence producers, agricultural workers and industrial workers, we could classify the two first groups together as rural population, and the third group could represent the urban population (even through the industrial and urban populations are not completely similar, as there is industry in rural areas, and some agriculture in urban areas). However, only fifteen countries have separate data on stunting in rural and urban populations. Fifteen countries are too few from which to generalize about the effects of land concentration on food security in developing countries.

indicates that land concentration will have different effects in the population that depends on agriculture for a living, compared to the population that doesn't depend on agriculture for a living. From the conceptual scheme we learned that high land concentration probably leads to higher food insecurity among the agricultural population, compared to the non-agricultural population. Food insecurity will be relatively high among the agricultural population because fewer people have access to land, and both labor absorption and wages are lower when land is concentrated in a few, large farms. For the food insecurity of industrial workers, on the other hand, high land concentration can be beneficial. The reason for this is that high land concentration probably produces a high agricultural surplus that, in turn, can spur industrial growth. Thus, labor absorption (and possibly wages) will increase.

This interaction between land concentration and the share of agricultural population tells us that when high land concentration is combined with a large agricultural population (relative to the non-agricultural population), *a large share of the total population will have low incomes.* (Most people in the country rely on agricultural production for incomes, but income opportunities are low.) This contributes to high food insecurity in the total population. However, the combined effect on food insecurity of these two variables depends on a third factor: namely, food prices. In the case above, where most people rely on agriculture for a living, and where land concentration is high, most people in the country will be net-buyers of food. The food insecurity of these people also depends on the price of food: if prices are high, their food insecurity will be high; if prices are low, they will be less food-insecure. Thus, the level of food insecurity in the total population depends on the interaction between land concentration and: 1) the share of agricultural population; and 2) food availability. In Figure 6.1 we can see how the effect of each one of these variables on food insecurity depends on the value of the other two (as described above).

Figure 6.1: Expected Interaction Effect of Land Concentration, Agricultural Population and Food Availability on Food Insecurity



Since there are country-comparable data on both the share of the total population that depends on agriculture for a living[3] and food availability, we can test how the interaction between these variables influences food insecurity. However, since I only have data on 41 cases, the model will have to include two two-way interactions (instead of one three-way interaction). Thus, the modeled interactions will be between land concentration and the share of agricultural population (on the one hand), and between land concentration and food availability (on the other).

It is important to point out that there are several other relationships in the conceptual scheme that I cannot test because of a lack of data. In particular, I do not have data on the prevalence and terms of tenancy (c.f., Figure 5.1.b), self-consumption in agriculture (or the share of subsistence production in total agricultural production), or the agricultural surplus (c.f., Figure 5.1.c). Furthermore, I have not been able to find data on the area planted with export crops or non-food crops, relative to the area planted with food crops for domestic consumption. Neither has it been possible to find comparable data on the distribution of income between landowners and agricultural workers, or between capital and labor in the industrial sector.[4]

I include three control variables on the basis of results from previous research on entitlements to food (see Section 2.4). First, I include GDP per capita because several studies have found that the level of income influences food insecurity. In addition, GDP per capita may influence food availability as countries with relatively high GDP per capita can import more food than countries with lower GDP per capita. The second control variable is war. I expect war to influence food insecurity both directly and indirectly via food availability, because it disrupts food production and distribution, and displaces people from their land, work and homes. The third control variable is for regime type. Based on previous research (by, e.g., Dréze and Sen 1989) I expect to find less food insecurity in democratic states (than in autocracies), because people (in theory) have more influence over (redistributional) policies in the former.

[3] And consequently the share that depends on incomes from non-agriculture.

[4] The gini coefficient for income would have been a good indicator for the distribution of income, but such data on the countries of the study are extremely patchy for the period between 1980 and 1990.

In addition to the three control variables that are included on the basis of previous research on entitlements to food, I include immunization rates as well as improved water source and sanitation as two additional control variables. These variables are included because the prevalence of stunting measure includes a disease component. [5] In Section 3.3 I explained how stunting is a result of both inadequate access to food and disease. In the nutrition literature these two variables are expected to affect the prevalence of disease. By controlling for these variables I can possibly isolate the effects that the other variables in the model have on the access to food, and obtain better estimates of their parameters.

Last, but not least, I have included two regional dummy variables. In Chapter 4 I found that there is lower prevalence of landlessness and tenancy in Sub-Saharan Africa and the Near East and North Africa than in the two other regions. It is probable that these conditions lead to lower food insecurity than we should otherwise expect from the level of land concentration reflected by the gini-coefficient for landholdings.[6] Since there is a lack of data that measure landlessness and tenancy, I will try to measure the effect of these differences in the poor's access to land by including two regional dummy variables, one representing Sub-Saharan Africa and the other the Near East and North Africa.[7]

Figure 6.2 presents a testable model for the causes of food insecurity in the total population of developing countries. I have removed all the variables that cannot be tested empirically, and arrived at a model that explains food security (in the total population) as a function of land concentration, food availability, the share of the agricultural population in total population, agricultural labor productivity, GDP per capita, civil war, regime type, immunization, improved water and sanitation facilities

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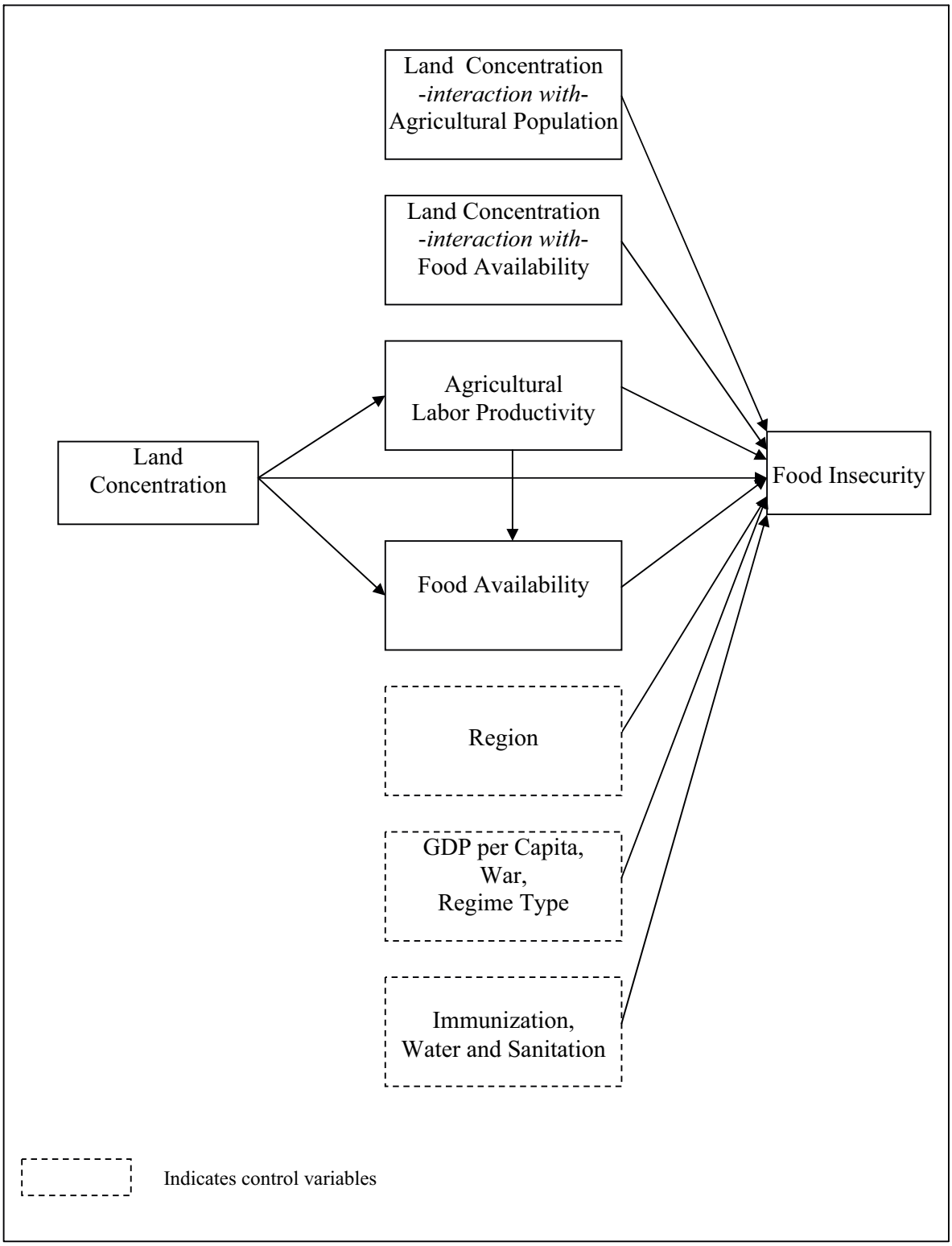
[5] As explained in Chapter 3, AIDS is probably an important cause of malnutrition today. However, since the epidemic started after the mid 1980s, which is when most of the surveys on the prevalence of stunting used in this study were undertaken, it cannot have had any significant effect on the data in this study, and will not be controlled for.

[6] The data on food insecurity in this analysis is from between 1980 and 1993. Today, I would expect the dummy for Sub-Saharan Africa to also reflect the fact that AIDS is much more widespread in this region (as food insecurity today is higher in this region than in any other).

[7] In a preliminary test with three regional dummies, to capture any possible differences between the regions (where Latin America and the Caribbean was the reference region), the (SPSS) program rejected the dummy for South East Asia. This means that there aren't any systematic differences between South East Asia and Latin America and the Caribbean that the model doesn't capture. This supports the assumption that it might be the differences in landlessness and tenancy, as discussed above and in Section 4.3.

Figure 6.2: Food Insecurity in Developing Countries: A Testable Model



as well as "region" (regional differences in agrarian structure not captured by the model).[8]

From this model it is clear that I expect land concentration to have a direct effect on food insecurity, as well as indirect effects via labor productivity and food availability. Since high food availability can mean both more food for subsistence producers and lower food prices for net-buyers, I also expect food availability (measured as the supply of food per capita in relation to requirements) to have an independent effect in addition to the interaction effect with land concentration. As labor productivity is important for both the amount of food that can be produced (per capita) and the incomes of agricultural and industrial workers, I expect it to have both a direct effect[9] and an indirect effect via food availability.[10]

All in all, we have arrived at a model of the causes of food insecurity in the total population that captures the most important dynamics of how land concentration affects food insecurity in developing countries. In addition, this model is designed in a manner that is empirically testable. I will test this model in Chapter 7, but first I will describe the indicators employed, and investigate some of the bivariate relationships.

6.2 The Indicators

This section aims to describe how the variables in Figure 6.2 will be operationalized, and to identify possible sources of error for the statistical analysis. The scores on the variables for each of the countries in the study are found in Appendix A.

As mentioned in Chapter 1, I use secondary data to test the model. For this reason it is important to point to an underlying danger in this approach: whether the data are comparable across countries. The data are often gathered by the countries

[8] Since I only have 41 cases, this model will have few degrees of freedom. This makes it difficult to obtain results that are significant at the 0.05-level, which I will use as a threshold. I will therefore look primarily at the size of the standardized regression coefficient and changes in the R^2 when I consider which variables (if any) to exclude (in the first respecification rounds).

[9] When I regress all the other independent variables of the model (of direct effects on food insecurity) on agricultural labor productivity, I get an R^2 of 0.757. This means that the tolerance of labor productivity is 0.243. This is close to 0.2, which is considered to be very low (Hamilton 1992: 134). However, I have chosen to include this variable in the first step of the regression analysis because I get sensible estimates even when it is included.

[10] In addition, I expect GDP per capita and civil war to influence food availability, but these effects are not depicted in the figure because it would make it very "untidy".

themselves, and sent to relevant agencies such as the WHO, the FAO, and the World Bank. Individual countries may classify the data differently, and cover different areas, people, incomes, etc. This, of course, is an unfortunate fact of life for development researchers: we use secondary data that are of varying, and often, poor quality. The results will therefore have to be interpreted with caution. In this section I discuss the validity and reliability of the indicators.

Land concentration is operationalized as the gini coefficient for the size distribution of landholdings. As mentioned in Chapter 4, this measure captures the distribution of agricultural land*holdings*, and not ownership. As defined in Section 4.2, a landholding is "all land that is held by a household or a person, whether it is owned, leased, or held on some other basis" (Bruce 1998b: 5). This means that my operationalization of land concentration incorporates both land that is owned by the operator, and land that the operator has on some form of tenancy arrangement. As I lack data on the prevalence and terms of tenancy for most of the countries in the study, I will not be able to control for the effect that tenancy (versus ownership) might have on food insecurity. In addition, the gini coefficient for landholdings does not reflect the level of landlessness. (I have therefore included two regional dummies that I elaborate on below.) The coefficient ranges from 0 to 1, where the value 0 represents an equal size distribution of holdings, while the value 1 describes a situation where all land is held in one holding. Because data on the gini coefficients for landholdings in developing countries are difficult to find, I will use data from the years 1980 to 1993 in order to include as many countries as possible in the analysis. (These data are not in a time-series format; country data are from different years over the period). I have strived to use the most recent gini coefficients available, and I have collected gini coefficients from five different sources.[11] Since the data are from so many different sources, comparability across countries may be a problem. For instance, the different sources might not use the same number of cohorts when estimating the gini coefficient. This could represent a problem because where fewer cohorts are used the gini coefficients will be underestimated (Fields 2001).

Food insecurity is operationalized as the prevalence of stunting in children under five (in percentage terms). The sources of these data are WHO (2000) for

[11] In particular: UNDP (1992: Table 2.2) and (1997: 198-99); Thiesenhusen (1995: 9); Alamgir and Arora (1991: 99-100); IFAD (2001: 119), UCLA (1999: Table 205).

India, Sommerfelt and Stewart (1994) for Trinidad and Tobago, and De Onis et al. (2000) for all other countries.[12] The stunting data are also from between 1980 and to 1993. Where data from more than one point of time (between 1980 and 1993) are available, the year closest to 1985 was chosen in order to be as close as possible to most of the other data in the study. The merits and problems associated with this indicator are described at length in Chapter 3.

The share of agricultural population in total population is operationalized as the economically active persons in agriculture and their dependents, as a percent of the total population. The source of these data is Jazairy et al. (1992: 404-8).

Food availability is operationalized as the per capita dietary energy supply as a percent of each country's average minimum energy requirements. These data are from the year 1985. Their source is Jazairy et al. (1992: 380-81).[13] The per capita dietary energy supply equals the domestic production[14] and imports of food (including aid), minus exports, stocks, feed and seed, divided by the total number of people in the country. The per capita dietary energy supply and the minimum energy requirement are both measured in terms of kcals per capita, per day. The minimum energy requirement is specified as the amount of kcals that is considered adequate to meet energy needs for light activity and good health. The energy requirement varies according to sex and age. Men and women, young and old, do not need the same amount of calories. Thus, average minimum requirements vary across countries according to the sex and age composition of the respective country's populations.

Agricultural labor productivity is operationalized as the value added in agriculture, per economically active person (in agriculture). Value added in agriculture includes the value added from forestry and fisheries. My data should exclude the forestry and fisheries sectors, but I have not been able to locate such data. These data are from 1985 (the same year as the food availability indicator), and

[12] All data are originally from the WHO (2000), but I have taken them from these other sources because they were more readily available.

[13] These data are only available for 1985 (and 1965).

[14] I have verified that this measure includes subsistence production by contacting Mr. Edward D. Gillin, Chief Basic Data Branch, Statistics Division, FAO.

are measured in constant 1995 US$. The source of this data is the World Bank's *World Development Indicators Online* (World Bank 2003).[15]

Land productivity is operationalized as the value added in agriculture per hectare of arable land. Arable land is the sum of land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or pasture, land under market or kitchen gardens, and temporary fallow. Land abandoned as a result of shifting cultivation is excluded. Value added in agriculture includes that from forestry and fisheries. Like the agricultural labor productivity indicator, it would have been preferable to use data that exclude the forestry and fisheries sectors, but I have been unable to find such data. These data are from 1985, and measured in constant 1995 US$. The source of these data is also *World Development Indicators Online* (World Bank 2003). The comparability of the data on land productivity and labor productivity should be relatively high, as they are from the same source and year, and both measured in constant 1995 US$.

The land/labor ratio is operationalized as hectares of arable land per economically active person in agriculture. I have calculated this ratio from data on arable land (as defined above) and the number of economically active persons in agriculture (male and female). The data on agricultural land are from 1985, while the data on the number of economically active people in agriculture are an average of 1980 and 1990 populations. The source of these data is FAOSTAT (FAO 2002b).[16]

As explained in Chapter 5, labor productivity is the product of the land/labor ratio and land productivity. To test the comparability of the indicators of labor productivity, land productivity and the land/labor ratio, I have performed a simple test. I began by calculating agricultural labor productivity by multiplying the land/labor ratio with land productivity (for all countries in the study). I then tested the correlation between the calculated agricultural labor productivity and the agricultural labor productivity data obtained from the World Bank (2003). The "Pearson's r" for this correlation was 0.872 (with a p-value of 0.000). Although the

[15] The distribution of the agricultural labor productivity variable is positively skewed, mostly because of the very high agricultural labor productivity in Uruguay. Thus, Uruguay is excluded in estimations where it is shown to have a high influence on the parameters, but otherwise Uruguay is included.

[16] The distribution of the land/labor ratio variable is positively skewed, mostly as a result of very high land/labor ratios in Uruguay and Mauritania. Categorization or logarithmic transformation does not much improve the distribution with regard to normality. Thus, I will exclude the two outliers from the analyses where they prove to have high influence on the estimated parameters.

correlation is not perfect, it is satisfactory. The discrepancy is most likely a result of the fact that the labor force data that are used to calculate the land/labor ratio is an average for 1980 and 1990, while the labor force data used by the World Bank when calculating the agricultural labor productivity is from 1985.[17]

The regional dummy variable for (possibly) capturing the differences in the incidence of landlessness and tenancy (not captured by the gini coefficient) between Sub-Saharan Africa, on the one hand, and Latin America and the Caribbean and South East Asia, on the other, has the value 1 for Sub-Saharan Africa and the value 0 for the other regions. The dummy that tries to capture these differences between the Near East and North Africa and the two reference regions (Latin America and the Caribbean and South East Asia) has the value 1 for the first, and 0 for all the other regions.

GDP per capita is measured in constant 1995 US$, for years matching the year of the data on stunting for each country. The source of these data is *World Development Indicators Online* (World Bank 2003). To control for war, I have chosen an indicator that captures the incidence of civil war within three years before food insecurity is measured. This is done because none of the countries in the analysis have experienced interstate war within three years before food insecurity was measured. I have chosen to include only civil wars within the last three years because it is unlikely that more distant civil wars (that ended more than three years prior to the year when food insecurity was measured) will significantly influence food insecurity. The data on (civil) wars are from the Uppsala dataset that is available on the internet (www.prio.no/cwp/datasets.asp). In this dataset, war is defined as "an incompatibility that concerns government or territory or both where the use of armed force between two parties results in at least 25 battle-related deaths. Of these two parties, at least one is a government of a state" (Gleditsch et al. 2002: 618-19). Originally, the civil war variable had three categories (low, medium, and high intensity, according to the number of battle-related deaths) and was negatively skewed. To avoid this problem, I have transformed the variable into a dummy where the value 0 represents no civil war, and the value 1 represents incidence of civil war.

Regime type is operationalized in terms of autocracy versus democracy on a scale from –10 (most autocratic) to +10 (most democratic). The variable reflects an

[17] I have not been able to get hold of the World Bank's labor force data from 1985.

average score on this scale for the five years prior to when stunting was measured. The source of these data is the Polity IV dataset that is available on the internet (www.bsos.umd.edu/cidcm/polity).

Immunization is operationalized as the average of the percent of children under one that is immunized against DPT and the percent that is immunized against measles. Improved water and sanitation facilities is measured in terms of the average of the percent of the population that has access to an improved water source and the percent that has access to sanitation facilities. The data on both of these indicators are from 1985, and their source is *World Development Indicators Online* (World Bank 2003).

Most variables, except the gini coefficient for landholdings, the prevalence of stunting (in children under five), the share of agricultural population, and GDP per capita are from 1985. Since land concentration changes slowly (even if land reform is being implemented), it should not be problematic that the data on this indicator are from five years prior, to eight years after, most other data. The prevalence of stunting generally changes faster than does land concentration, and the fact that these data are not always the same as the other indicators may be a source of error.

The distributions of all variables (except the dummies) are tested for univariate normality. All of the variables except agricultural labor productivity and the land/labor ratio were found to be acceptable.

There are approximately 100 developing countries in the world (Alexandratos 1995: 404), but I have only been able to find requisite data on 41 of them. For statistical analyses in general, 41 cases is a small sample. However, this sample embraces 41 percent of the developing countries. It is also a relatively large sample compared to other studies of land distribution in developing countries. There is no clear pattern over what types of countries are included (or missing) in the sample.[18]

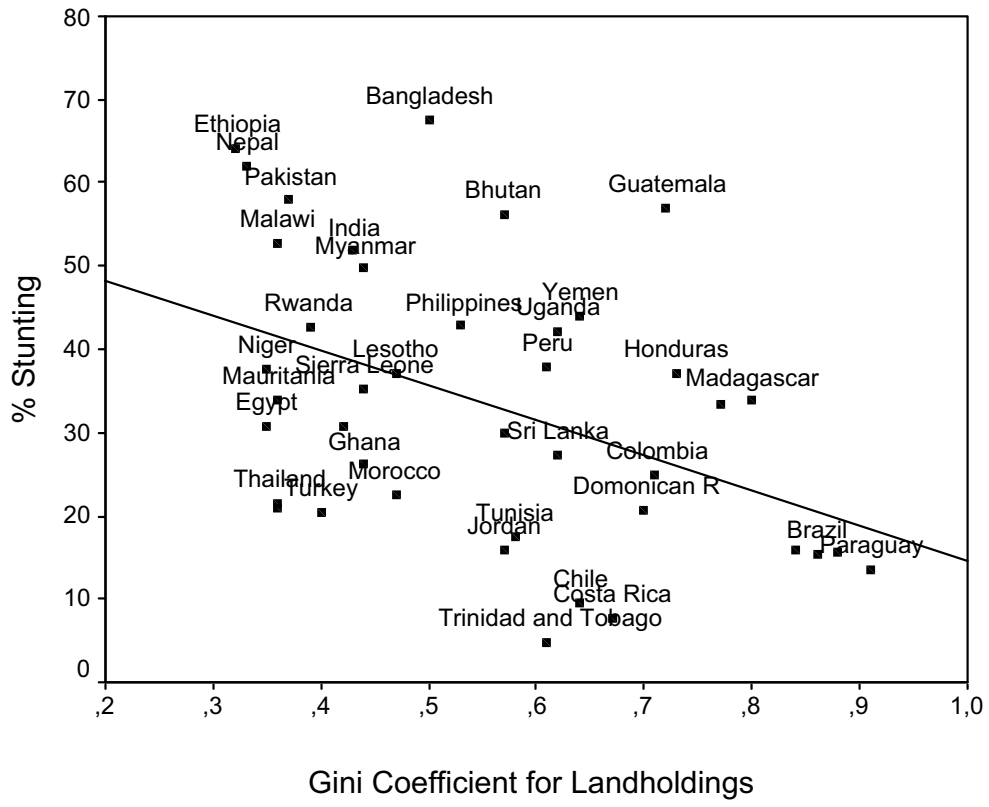
6.3 Bivariate Correlations with Food Insecurity

The purpose of this section is to analyze the bivariate correlations between food insecurity and the variables in the model. In the subsequent chapter I test the model's direct effects on food insecurity with multivariate regression analyses.

[18] For instance, I have data on developing countries with very low and very high levels of GDP per capita. The individual countries' values on most variables are also relatively evenly spread, since they are close to the normal distribution.

I will start with a correlation analysis of the relationship between land concentration and food insecurity. This will give us a starting point for unraveling the interaction effects and the indirect effects that land concentration has on food insecurity. Figure 6.3 provides a scatter plot of this bivariate analysis.

Figure 6.3: Land Concentration and Food Insecurity



Note: Pearson's r = -0.436, p-value = 0.004
Operationalization and Sources: See Section 6.2

We can see from Figure 6.3 that there is a *negative* relationship between land concentration and food insecurity. The "Pearson's r" for this relationship is -0.436, with a corresponding p-value of 0.004.[19] This means that food insecurity is generally lower in countries that have high levels of land concentration than in countries that

[19] The p-value is the same as the probability value, and reflects the smallest level of significance for which the observed sample information becomes significant, provided the null hypothesis is true (Johnson 1992: 407).

have low levels of land concentration.[20] We can see that Paraguay and Brazil, which have very high gini coefficients for landholdings, have a relatively low prevalence of stunting. On the other hand, Ethiopia and Nepal have very low gini coefficients and very high prevalences of stunting. The negative relationship is interesting because it is contrary to the intuitive expectation that high land concentration gives high food insecurity. As I discussed in Chapter 5, however, this negative correlation can be explained by the expectation that land concentration affects different groups (within a given country) in different ways.

Figure 6.3 also reveals that it is Trinidad and Tobago, Costa Rica, and Chile that have the lowest level of stunting (among the countries of the study), closely followed by Paraguay, Brazil, Jordan and Tunisia (as well as Uruguay and Panama, though their names are not visible because the dots are too close to Brazil and Paraguay). These countries are found in the vicinity of the lower right hand corner, which means that they have a high gini coefficient (for landholdings) and a low prevalence of stunting. Most of the Latin American countries in the study are found in this lower right hand corner (except Guatemala, Peru and Honduras, which have much higher levels of stunting). In the upper left hand corner, which constitutes countries with low gini coefficient and high prevalence of stunting, we find nearly all the South East Asian countries (except Thailand) and some of the Sub-Saharan countries.

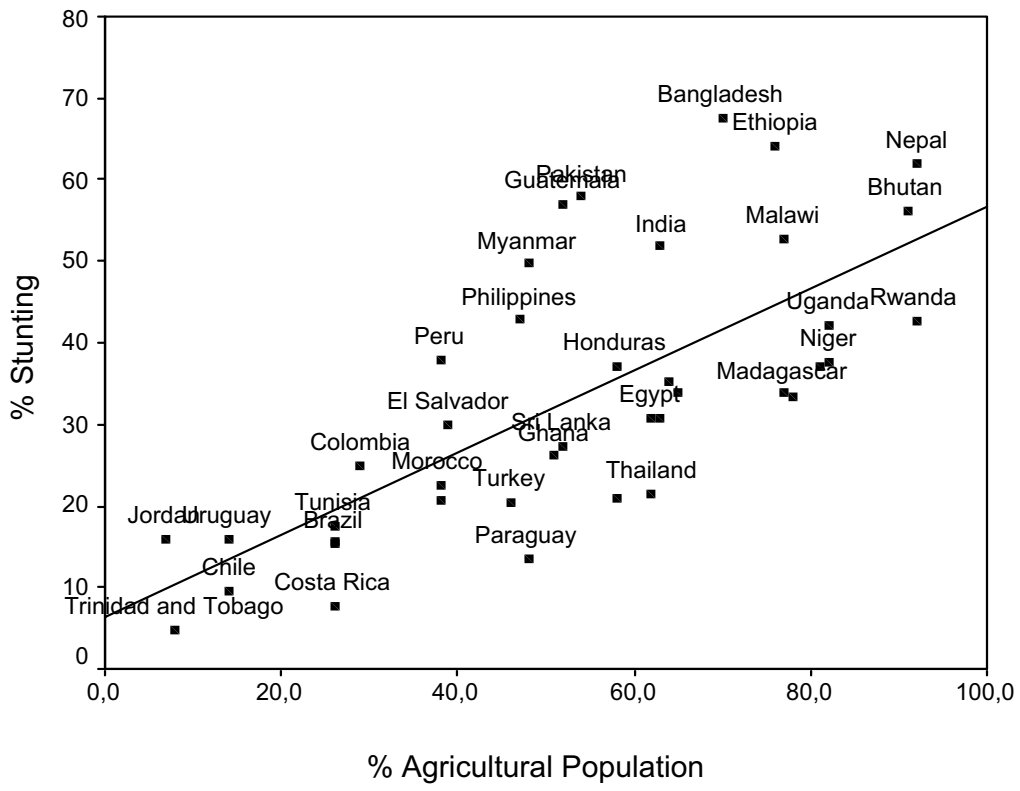
We can further see from Figure 6.3 that most of the values on the gini coefficient are associated with both high and low levels of food insecurity. When we compare Trinidad and Tobago with Bhutan, two countries with approximately the same gini coefficient for landholdings, we see that the prevalence of stunting is only 4.8 in the former country, but as high as 56.1 in the latter. Thailand and Pakistan are also examples of a pair of countries with approximately the same gini coefficient for landholdings, but highly divergent prevalences of stunting. While their gini coefficients are close to 0.35, the prevalence of stunting is "only" 21.5 in Thailand, but as high as 57.9 in Pakistan.

As explained above, I expect the effect of land concentration to depend on the share of the agricultural population (in the total population) and the level of food

[20] From the scatter plot (Figure 6.3) it looks as though the relationship may be curvilinear. However, the curvilinear relationship is weaker than the linear.

availability. When we study Figures 6.4 and 6.5, it is interesting to note that Trinidad and Tobago (with lower prevalences of stunting) has a very small share of agricultural population (only eight percent) and a high food availability ratio (120 percent). In contrast, Bhutan has an agricultural population of 91 percent and a food availability ratio of 107 percent. The lower prevalence of stunting in Trinidad and Tobago—despite the same level of land concentration as in Bhutan—can possibly be explained by the combination of high land concentration, small share of agricultural population, and a high level of food availability. On the other hand, in the cases of Thailand and Pakistan, the pattern is partly reversed. Thailand, with a much lower stunting level, has a larger share of agricultural population (62 percent) than Pakistan (54 percent). However, Thailand has a higher food availability ratio (108) than Pakistan (94), and this can perhaps explain why the former has a lower prevalence of stunting than the latter (despite equal levels of land concentration).

Figure 6.4: The Share of Agricultural Population and Food Insecurity



Note: Pearson's r = 0.716, p-value = 0.000
Operationalization and Sources: See Section 6.2

Furthermore, in Figure 6.4 we see that the relationship between the percent of agricultural population (of total population) is positively correlated with the prevalence of stunting. The "Pearson's r" for this relationship is 0.716, and the p-value 0.000. However, this does not mean that there is an independent, causal relationship from the former to the latter. The share of the agricultural population does not have any influence on food insecurity in itself. It is merely a contextual variable that influences how land concentration affects stunting.[21]

When we study Figure 6.4 more closely, we see that the (mostly Latin American) countries in the lower right hand corner in Figure 6.3 (high gini coefficient and low stunting) are found in the lower left hand corner of Figure 6.4. This means that countries with high gini coefficients for landholdings and low stunting levels also have small shares of agricultural population. This is consistent with my expectation that high land concentration is beneficial (for food security) in countries where most of the people do not depend on agriculture for a living. With further examination of Figure 6.4, we see that the South East Asian countries that we found in the upper left hand corner of Figure 6.3 (low gini coefficients and high stunting levels) are situated in the upper right corner of Figure 6.4. Thus, countries with low gini coefficients for landholdings and high stunting levels also have a large share of agricultural population. This is less consistent with my expectations, as I expected low land concentration to be beneficial for countries with a larger share of agricultural population.[22]

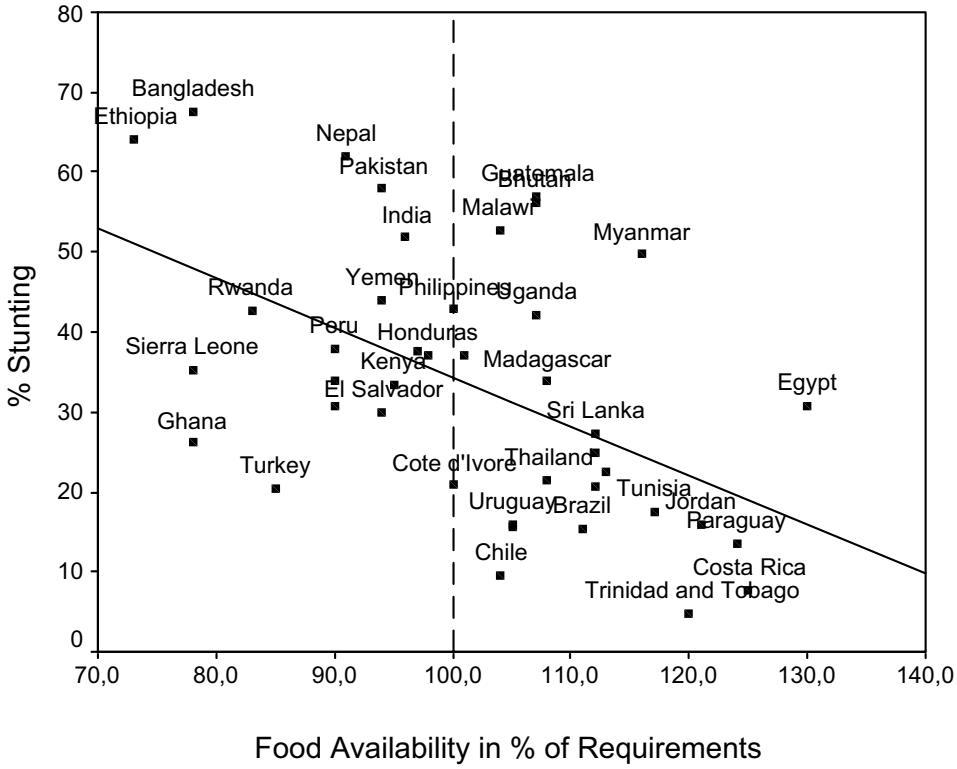
The explanation for this phenomenon may be found in the level of food availability in these countries. When we look at Figure 6.5, we see that the (South East Asian and Sub-Saharan) countries in the upper left corner of Figure 6.3 (low land concentration and high prevalence of stunting), and the upper right section of Figure 6.4 (large agricultural population and high stunting), are also found in the upper left hand corner of Figure 6.5. This means that they have low food availability. It is possible that the low level of food availability in these countries is responsible for the high levels of stunting.

[21] It might also reflect a lower level of labor productivity in agriculture, compared to industry.

[22] I will test and explain this interaction effect (as well as the interaction between land concentration and food availability) statistically in the multivariate regression analysis in Chapter 7.

Furthermore, Figure 6.5 shows that food availability is negatively correlated with the prevalence of stunting. The ”Pearson’s r” coefficient for this relationship is relatively strong (-0.514) and the p-value is low (0.001). This is as expected: high food availability should mean more food for subsistence producers and lower prices for net-buyers of food.

Figure 6.5: Food Availability Ratio and Food Insecurity



Note: Pearson’s r = -0.514, p-value = 0.001
Operationalization and Sources: See Section 6.2

The dotted, vertical line in Figure 6.5 marks a food availability ratio of 100 percent. Countries at this ratio have just enough food to cover the minimum needs of their population, assuming it is evenly distributed. Countries with food availability ratios above 100 percent have more food than the absolute minimum, while countries with food availability ratios below 100 percent do not have enough food to feed the whole population at a bare minimum, even if the food were equally distributed. In these countries, some people will necessarily be undernourished, and the extent of

undernourishment depends on the income distribution.[23] What is interesting to note in Figure 6.5 is that as many as 17 of the 41 countries have a food availability ratio of less than 100 percent. In the upper left hand corner of this figure we find countries with a very low food availability ratio combined with a very high prevalence of stunting. Here we find Ethiopia (with a food availability ratio of 73 percent, and a stunting prevalence of 64.2 percent), and Bangladesh (with a food availability ratio of 78, combined with a stunting prevalence of 67.5 percent). These two cases (as well as Nepal, Pakistan and India, which also have low food availability ratios and a high prevalence of stunting) support the argument that low food availability produces high levels of food insecurity.

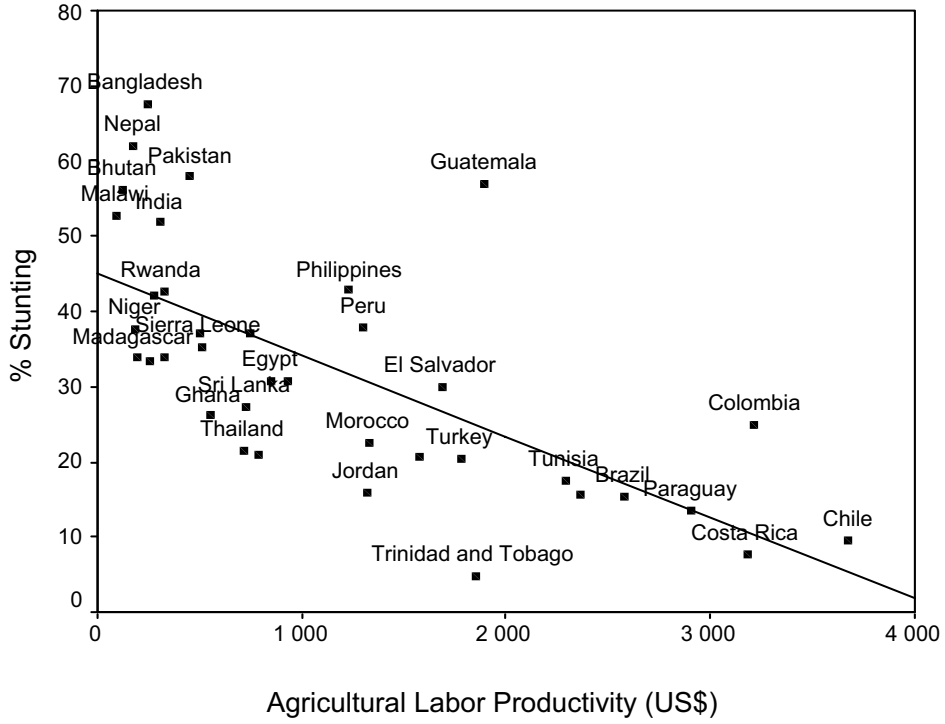
Ghana and Turkey, on the other hand, are interesting cases in that they have very low food availability ratios (78 and 85, respectively), but a relatively low prevalence of stunting (26 percent and 20.5 percent, respectively). This conflicts with my expectations. To explain the low prevalence of stunting in these two countries, we can return to Figures 6.3 and 6.4 to examine their level of land concentration and share of the agricultural population. We can see from Figure 6.3 that Ghana's gini coefficient for landholdings is 0.44, and Turkey's is 0.40. These gini coefficients are among the very lowest of the countries in this study. Additionally, in both countries the share of the agricultural population is about 50 percent. The low stunting in these countries can probably (at least partly) be explained by their low levels of land concentration, combined with moderately sized agricultural populations (which can possibly produce a relatively equal income distribution). Thus, it is possible that the food available in these countries is relatively equally distributed: this should produce less food insecurity than if the food were distributed in a manner that gives a few people much more than they need, and a majority of the people much less than they need.

By studying Figures 6.3, 6.4 and 6.5 we have visually analyzed how the effect of land concentration depends on the share of the agricultural population and the level of food availability. In order to obtain firmer results that (hopefully) can be generalized to developing countries beyond this study; I will test these interaction

[23] It is more correct to say that it depends on the distribution of endowments, but I use income consistent with the rest of the discussion in Chapter 5.

effects in a multivariate regression analysis in the following chapter.[24] Before doing this, I will discuss the correlation between agricultural labor productivity and stunting, and take a brief look at the correlations between stunting and the control-variables GDP per capita, regime type, civil war, immunization and water and sanitation.

Figure 6.6: Agricultural Labor Productivity and Food Insecurity



Note: Pearson's r = -0.611, p-value = 0.000
Operationalization and Sources: See Section 6.2

In accordance with the conceptual scheme from Chapter 5, I expect agricultural labor productivity to be negatively correlated with food insecurity. Higher labor productivity gives subsistence producers more food from their land and the possibility for better incomes and lower food prices for agricultural and industrial workers alike. Figure 6.6 confirms the overall expectation that agricultural labor

[24] I have chosen not to include scatter plots of the prevalence of stunting against the two interaction variables in the model. The reason for this is that these plots do not provide insight into how the interactions work. To illustrate how the interactions influence the prevalence of stunting I will include conditional effect plots after I have arrived at my final model of food insecurity (with the help of multivariate regression analyses).

productivity is negatively correlated with food insecurity. The "Pearson's r" for this relationship is -0.611 with a p-value of 0.000.[25]

We can see that most countries with high agricultural labor productivity also have low levels of stunting. Only Latin American countries and Tunisia are situated in this lower right hand corner of the figure (high labor productivity and low prevalence of stunting). In the center of the figure, where a medium level of agricultural labor productivity is combined with a medium prevalence of stunting, we find mostly countries in the Near East and North Africa. The Sub-Saharan and South East Asian countries are located in the upper left-hand corner, where low agricultural productivity is combined with a high prevalence of stunting. There are a few exceptions to this pattern. Thailand and Ghana, for instance, have low levels of agricultural labor productivity but relatively low levels of stunting. Guatemala has a medium level of agricultural productivity, but a very high stunting level. Colombia has a somewhat higher stunting level than the other Latin American countries with more or less the same level of agricultural labor productivity. Finally, Trinidad and Tobago has only a medium level of agricultural productivity, but the lowest prevalence of stunting in the sample.

It is interesting to compare Trinidad and Tobago with Guatemala, as the two countries have approximately the same level of agricultural productivity, but the prevalence of stunting is only 4.8 percent in the former and as high as 57 percent in the latter. To explain this divergence in the prevalence of stunting, I note that the two countries do not differ very much with regard to land concentration and food availability, but that Trinidad and Tobago has a very low share of agricultural population, combined with higher immunization rates. In addition, there was civil war in Guatemala, but not in Trinidad and Tobago. Thus, an explanation for the much higher prevalence of stunting in Guatemala, compared to Trinidad and Tobago, is likely found in the different values on the three latter variables.

The GDP per capita control variable has a strong, negative, correlation with stunting (with a "Pearson's r" of –0.686 and a p-value of 0.000). This means that there is lower stunting in countries with a high GDP per capita. However, in line with

[25] Uruguay with a labor productivity of 6,537 US$ and a prevalence of stunting of 15.9 percent, is not included in the scatter plot (but is included in the estimation of "Pearson's r") because it makes most other countries appear so close together that I cannot show their names. When Uruguay is excluded from the "Pearson's r", it increases to -0.677 with a p-value of 0.000.

the argument that the level of economic development per se does not much affect food insecurity, but that it mostly facilitates redistributional policies that have stronger effects (e.g., Sen (1981 and 1989); Drèze and Sen (1989); World Bank (1986); see Section 2.4), I do not expect GDP per capita to have a strong *independent* effect on food insecurity (but that this strong correlation results from the correlation between GDP per capita and other variables that also have an effect).

The correlation between the regime-type control variable and the prevalence of stunting is very weak and negative (the "Pearson's r" is -.254 with a p-value of 0.109). The negative correlation means that there is less stunting in countries that are more democratic. The very high levels of stunting in India, Pakistan and Nepal, combined with their relatively high scores on the democracy scale, explain part of the reason why the correlation is weak. In addition, Chile, Jordan and (to a lesser degree) Paraguay and Tunisia have relatively autocratic regimes combined with a low prevalence of stunting.

The civil war control variable is positively correlated to stunting, with a "Pearson's r" of 0.331 and a p-value of 0.035. Thus, there is a weak tendency for countries suffering from civil war to have a higher prevalence of stunting. Bangladesh and Ethiopia, two countries with the highest occurrences of stunting, have both experienced civil war. In contrast, the Latin American countries with very low levels of food insecurity (and favorable conditions of agricultural population, food availability and agricultural productivity) have not experienced civil war. We should also take notice of Guatemala and Peru—countries with a much higher prevalence of stunting than the other Latin American countries (except Honduras)—despite more or less similar values on most of the other casual variables. The data show that there was (in the mid 1980s) civil war in these two countries. This is a possible explanation for their higher level of food insecurity.

The immunization rate has a strong, negative correlation with stunting, with a "Pearson's r" of –0.634 and a p-value of 0.000. Furthermore, access to an improved water source and sanitation facilities also has a relatively strong, negative, correlation with stunting, with a "Pearson's r" of –0.564 with a p-value of 0.001. This means that there is less stunting in countries where more children are immunized, and/or more people have access to (relatively) clean water and sanitation.

6.4 Summary

This chapter has had three purposes. The first was to discuss how the lack of data for several of the relationships has made it necessary to reformulate the conceptual scheme into a more testable model. The most important shortcoming that results from this process is that the testable model does not distinguish between the effects of land concentration on peasants, landowners and non-agricultural workers, respectively. I was able to compensate for some of this loss by including an interaction term between land concentration and the share of the agricultural population in the model. The function of this interaction term is to elucidate possible differences in the effect of land concentration on the food insecurity of those who depend on agriculture for a living, compared to those who do not.

The second purpose of this chapter was to describe how the variables in the model are operationalized and measured.

The third purpose was to analyze the bivariate relationships between the prevalence of stunting and all the variables in the model (except the regional dummies that have little meaning in this bivariate analysis, because they are meant to capture the variation in food insecurity that is not explained by the other variables in the multivariate model). I found that:

1) Land concentration is negatively correlated with the prevalence of stunting (which means that there is generally a lower prevalence of stunting in countries with high levels of land concentration);
2) The share of agricultural population is positively correlated with the prevalence of stunting (which means that there is more food insecurity in countries where a large share of the population depend on agriculture for a living);
3) Food availability is negatively correlated with the prevalence of stunting (which means that there is generally lower stunting where food availability is high);
4) Agricultural labor productivity is negatively correlated with the prevalence of stunting (this means that where labor productivity is high there is less stunting);
5) The control variables for GDP per capita, regime-type, immunization, and access to improved water source and sanitation facilities are all negatively

correlated with the prevalence of stunting (this means that there tends to be less stunting in countries that have high values on these variables); and finally that

6) Civil war is positively correlated with the prevalence of stunting (thus, there is generally more stunting in countries where there was civil war).

Of course, these bivariate correlations might be explained by the presence of certain values on any of the other variables in the model (as well as variables not captured by the model). In other words, bivariate correlation analyses cannot separate the effects of one variable from another. In order to see how each of these independent variables influences the prevalence of stunting, we have to control for the effect of all the others (in the model). Therefore, I now turn to multivariate regression analyses, which is the focus of Chapter 7.

7

Multivariate Analyses

In the previous chapter we moved from the conceptual scheme to a testable model of the causes of food insecurity in the developing world. We also studied the bivariate relationships between the prevalence of stunting in children under the age of five and each of the variables in the model.[1] However, in order to estimate the independent effect of each of the variables in the model, we need to employ a multivariate regression analysis. This is the purpose of the present chapter.

The model in Figure 6.2 contains both direct and indirect effects on food insecurity. However, I was not able to compile data on enough countries to analyze the whole model as one.[2] Thus, I will split the model into three sub-models, analyze these one by one, and combine them in a path analysis at the end.[3] The first sub-model considers the direct effects on food insecurity. This is the focus of Section 7.1. The second sub-model estimates the influence of land concentration and labor productivity in agriculture on the level of food availability. This model is tested in Sub-Section 7.2.1. The third sub-model is on how labor productivity in agriculture is influenced by land concentration, and is tested in Sub-Section 7.2.2. On the basis of the results from Sections 7.1 and 7.2, I use Section 7.3 to combine the three sub-models and discuss the direct and indirect effects of land concentration on food insecurity. Section 7.4 summarizes.

7.1 Direct Effects on Food Insecurity

In this section I will test the direct effects in this model of food insecurity by using multivariate regression analyses.[4] I will test the indirect effects in the two

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[1] Except for the regional dummies, as explained in Chapter 6.

[2] If I had more cases I could analyse a whole model with direct and indirect effects in, for instance, LISREL. However, to perform such an analysis a minimum of approximately 150 cases is needed (Anderson and Gerbing 1988: 415).

[3] Because the indirect effects go through variables that are interaction terms, the path-analysis will be informal in nature.

[4] I use the Ordinary Least Squares (OLS) estimator in SPSS for Windows (Version 10.0), and exclude missing cases pairwise. Regression analysis provides the direction of relationships, but does not assess causality. The analyses can, for example, tell us how much food insecurity is expected to decline

subsequent sections.[5] Based on expectations within the model of the causes of food insecurity in Figure 6.2, which were supported by the results of the bivariate correlation analyses in the previous chapter, I will test the following hypotheses:

- H_1: Land concentration has a direct negative effect on the prevalence of stunting;
- H_2: Land concentration interacts with the share of the agricultural population in its influence on the prevalence of stunting;
- H_3: Land concentration interacts with the level of food availability in its influence on the prevalence of stunting;
- H_4: Food availability has an independent negative effect on the prevalence of stunting;
- H_5: Agricultural labor productivity has an independent negative effect on the prevalence of stunting;
- H_6: The regional dummies for Sub-Saharan Africa and the Near East and North Africa have independent negative effects on stunting;
- H_7: If they have any effect, the control variables for GDP per capita, regime type, immunization, and water and sanitation will have negative effects on the prevalence of stunting; and
- H_8: If it has any effect, civil war will have a positive effect on the prevalence of stunting.

Since I have only 41 cases, it is very unlikely that all of these variables will be significant; I am working with very few degrees of freedom. I will therefore focus on the standardized regression coefficients[6] when I determine whether each of the variables has an effect and should remain in the model, or if they do not have an

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when food availability increases by one unit. But, it does not say that the increase in food availability causes the decline in food insecurity. As far as the result of the regression analyses are concerned, it could be a decrease in food insecurity that causes the rise in food availability. It is only on the basis of theoretical reasoning that causality can be associated with these relationships.

[5] I have tested all the variables for collinearity and multicollinearity. Agricultural labor productivity is on the borderline with regard to multicollinearity, as it has a tolerance of only 0.233 (see Section 6.2). Otherwise, there are no collinearity or multicollinearity problems with the variables in the model. I have also tested for curve-linearity, finding none. I have compared the univariate distribution of all variables to the normal distribution. The only variables that deviate considerably are agricultural labor productivity and the land/labor ratio. As explained in Section 6.2, I have excluded outliers, but otherwise kept the variables in their original form.

[6] By examining the *standardized* coefficients we see how strong the effects are, relative to other variables.

effect and should be removed. I will use +/- 0.2 as an approximate lower limit for inclusion in the model. Because both the absolute and the standardized parameters of all variables will change when a variable is removed from the model, I will carry out step-wise removal of the variables that have no effect. I will also successively reintroduce previously removed variables when a new variable is removed, to see if it has a (significant) effect when these other variables have been removed. When the number of variables decrease, and the degrees of freedom increase, I will also consider the p-value (the level of significance is set at 0.05) and changes in R^2. However, I only describe the first and the final model in the text of this chapter. The outcomes of the intermediate analyses are presented in Appendix B.

Table 7.1 shows the results of the tests on H_1 to H_8:

Table 7.1: First Model of Direct Effects on Food Insecurity

	Unstandardized Coefficients (B)	Standardized Coefficients (Beta)	P-value
(Constant)	69.304		0.458
Gini coefficient for landholdings	- 21.466	- 0.234	0.915
Interaction gini landholdings & agric. population	0.776	0.673	0.129
Food availability ratio	- 0.176	- 0.141	0.863
Interaction gini landholdings & food avail. ratio	- 0.310	- 0.429	0.858
Agricultural labor productivity	-1.919E-03	- 0.122	0.704
Sub-Saharan Africa	- 22.596	- 0.678	0.022
North Africa and the Near East	- 8.133	- 0.184	0.495
GDP per capita	- 1.217E-03	- 0.071	0.835
Civil war	2.855	0.088	0.594
Regime type	- 0.357	- 0.137	0.569
Immunization	- 5.444E-02	- 0.080	0.748
Water and sanitation	4.782E-02	0.050	0.863

Note: $R^2 = 0.772$, N = 27
Operationalization and Sources: See Section 6.2

We can see that the R^2 is 0.772, which means that the model explains about 77 percent of the variation in stunting. This is a relatively high R^2, especially when we consider that we could not include all the desirable variables because of a lack of data. When we look at the individual standardized parameters (beta coefficients) of the model, we see that the interaction effect between land concentration and the share of agricultural population, the interaction effect between land concentration and food availability, as well as the dummy for Sub-Saharan Africa have the strongest standardized beta coefficients (0.673 and - 0.429, and -0.678, respectively).

The other variables, with the possible exception of the gini coefficient for landholdings, have very low beta coefficients. The beta coefficient on water and sanitation is the lowest, and is removed first. In the following model, the beta coefficient of GDP per capita is lowest, and therefore removed. Thereafter, variables were removed in the following order: the gini coefficient for landholding (alone), the food availability ratio (alone), civil war, immunization, and finally agricultural labor productivity. However, immunization had a strong (enough) and significant effect when reintroduced into the model after labor productivity was removed, and is therefore included in the final model (of direct effects).

Thus, it seems that neither land concentration (represented by the gini coefficient for landholdings), nor food availability has an independent effect. Land concentration only has an effect in interaction with the share of agricultural population and food availability, and food availability only has an effect in the interaction with land concentration. This is not surprising. It is probably the consequence of two factors. First, from the theoretical discussion, I expected that income and food prices had to been seen in conjunction with each other, and not separately. The entitlement mapping depends on both income (and assets) and the price of food. Since (I expect that) land concentration influences the incomes of both agricultural and industrial workers (see Section 5.2), it can serve as an indication of the income levels of these two groups. Thus, neither land concentration (representing income) nor food availability (representing food prices) will have independent effects. However, for peasants, low land concentration should give more land, and lower food insecurity. In addition, food availability would affect food insecurity if it were too low to cover the population's minimum needs, even if it were equally distributed (as is the case in many of the countries of this study). When land concentration and food availability nevertheless do not have an independent effect, a possible reason is that land concentration is represented by three variables in the model simultaneously (in both interaction terms and alone) and food availability would be represented twice. With only 41 cases in the analysis, it is possible that the lack of effect is a result of too few cases. Of course, this may also be the case for the other variables that have been removed from the model.

Agricultural labor productivity does not have a direct effect. This is most probably a result of the variable's low tolerance level with regard to multicollinearity

(primarily because of its relationships with the gini coefficient for landholdings, the share of agricultural population, and the food availability ratio). In Section 7.2, we will see that land concentration affects agricultural labor productivity, and that agricultural labor productivity affects food availability. Thus, it is possible that any direct effect of agricultural labor productivity on food insecurity is captured by the gini coefficient, the share of agricultural population, and the food availability ratio.[7]

The GDP per capita variable does not have an effect on stunting. This finding supports the expectations of a dominant school within the entitlement approach, which claims that it is not so much the level of economic development that matters for food security, but rather how wealth and income is distributed.

Furthermore, civil war does not have an effect on stunting. This is rather unexpected. A possible explanation for the lack of effect may be that only prolonged (civil) wars will deplete resources that could have been used for obtaining food security (or lead to migration, and disrupt food production and its distribution). In addition, it could be that only very intense wars affect food insecurity, and that the dummy variable for civil war does not capture, for instance, how many people died in the conflict. It is also possible that the effect of civil war is captured by other variables included in the model, such as food availability.[8]

In addition, access to improved water and sanitation facilities does not have an effect on stunting. This may be because disease is much less important for the nutritional status (of children under five) than is access to food. Thus, the effect of disease on the prevalence of stunting (independent of food intake) may be too small for both immunization and access to improved water and sanitation facilities to have independent effects.

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[7] I could have kept agricultural labor productivity in the model to show its weak and insignificant direct influence on food insecurity, as it is a variable that is theoretically important. The decision to remove the variable from the final model (of direct effects) rests on the high p-value (0.190), in combination with the low standardized coefficient (-0.217), and the fact that R^2 would only improve by 0.005 by its inclusion. Keeping agricultural labor productivity in the model would therefore not increase the model's explanatory power, and make it less robust.

[8] Another possible explanation might have been that civil wars take place mostly in less democratic states, and that the effect of civil war might be captured by the regime type variable. This explanation is ruled out be the very low correlation between civil war and regime type (– 0.125 with p-value 0.437).

On the basis of the results from the respecification rounds (see Appendix B) I arrived at a final model for the direct effects on food insecurity. This model is found in Table 7.2.

Table 7.2: Final Model of Direct Effects on Food Insecurity

	Unstandardized Coefficients (B)	Standardized Coefficients (Beta)	P-value
Constant	60.046		0.000
Interaction gini landholdings & agric. population	0.711	0.574	0.000
Interaction gini for landholdings & food avail. ratio	- 0.552	- 0.725	0.000
Sub-Saharan Africa	- 21.549	- 0.598	0.000
Near East and North Africa	- 12.419	- 0.250	0.018
Regime type	- 0.648	- 0.248	0.030
Immunization	- 0.153	- 0.218	0.044

Note: R^2 = 0.790, N = 39
Operationalization and Sources: See Section 6.2

The R^2 for this model is 0.790. In Table 7.2 we find acceptable beta-coefficients (that are significant at the 0.05 level) for: the interaction effect between land concentration and the share of the agricultural population; the interaction effect between land concentration and food availability; the dummy variables for Sub-Saharan Africa and the Near East and North Africa; as well as regime type and immunization. We can further see that all the variables except the interaction between land concentration and the share of agricultural population have negative effects. This means that the higher the scores on these variables, the lower is the predicted prevalence of stunting. The positive effect of the interaction between land concentration and the share of the agricultural population means that high scores on this variable increase the predicted value of stunting.

The interaction effect between land concentration and food availability has the strongest effect, with a beta coefficient as high as – 0.725. The dummy variable for Sub-Saharan Africa has a slightly lower effect, with a beta coefficient of – 0.598. The interaction effect between land concentration and the share of the agricultural population also has a relatively strong effect, with a beta coefficient of 0.574. The dummy for the Near East and North Africa has a relatively weak (standardized) effect of – 0.250. The control variables for regime type and immunization also have relatively weak effects, with beta coefficients of – 0.248 and – 0.218, respectively.

The dummy variables for Sub-Saharan Africa and the Near East and North Africa have the expected negative effects. This confirms that there is "something" about these regions that leads to lower food insecurity than the model otherwise

would predict (and that this "something" is not captured by the other variables in the model). I assume that these dummy variables capture the effect of lower prevalence of landlessness and tenancy in these two regions.[9]

The positive effect from regime type means that more democratic states have less stunting. The fact that regime type has this effect supports an argument from the dominant branch within the entitlement approach: that public action and participation is important for achieving the redistributional policies (that are crucial for low food insecurity) (e.g., Sen 1981 and 1989; Drèze and Sen 1989). The regime type variable captures this because the possibilities for political participation by the poor are (at least in principle) better in democracies than in autocracies.

That immunization has an effect indicates that measures to reduce the propensity for disease among the food-insecure halt the downward spiral of malnutrition as a consequence of inadequate access to food, weakened immune systems, disease, loss of appetite, and further malnutrition (as explained in Chapter 3).

Thus, I have arrived at a satisfactory model of the causes of food insecurity in developing countries.[10] This model can be described with the following formula:[11]

$$\check{r} = 60.046 + 0.711*X_1 - 0.552*X_2 - 21.549*X_3 - 12.419*X_4 - 0.648*X_5 - 0.153*X_6 + \dot{A} \quad (7.1)$$

where

X_1= Interaction of the gini coefficient for landholdings and share of the agricultural population;
X_2= Interaction of the gini coefficient for landholdings and the food availability ratio;
X_3= Dummy for Sub-Saharan Africa;
X_4= Dummy for the Near East and North Africa;

[9] As it is uncertain what these dummies capture, I tested the effect of a third regional dummy variable representing South East Asia (as this dummy could have effect for other reasons) making Latin America and the Caribbean the only reference region. However, this dummy variable was rejected by the (SPSS) program, which means that it does not have an effect. This offers some support for the assumption that the effects of the two other regional dummies represent the lower prevalence of landlessness and tenancy that characterise Sub-Saharan Africa and the Near East and North Africa compared to the other two regions

[10] The residual versus predicted Y plot shows no signs of heteroscedasticity.

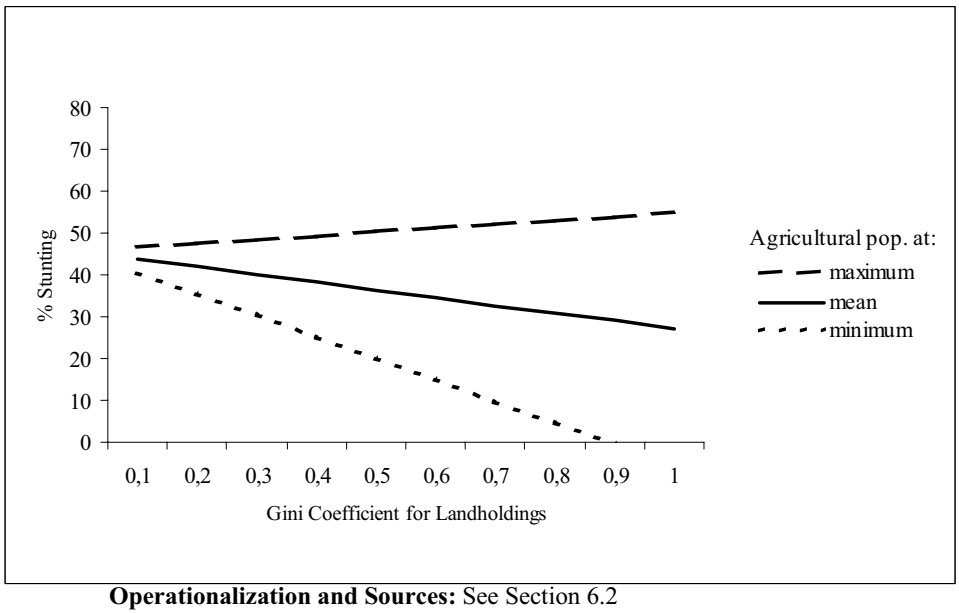
[11] These coefficients are unstandardized.

X_5= Regime type; and
X_6= Immunization.

We have seen that the interaction effect between land concentration and the share of the agricultural population is positive with an un-standardized regression coefficient of 0.711. This tells us that when the interaction variable increases by one unit, stunting will increase by 0.711 percent. The respective coefficient for the interaction between land concentration and food availability is –0.552, which means that when this interaction variable increases by one unit, stunting decreases by 0.552 percent. However, it is hard to interpret *how* these variables interact from the regression coefficients alone. This is especially true in the interaction between land concentration and the share of the agricultural population, as the individual variables' correlations with stunting have opposite signs.

Conditional effect plots can help us understand these interaction effects. Figure 7.1 illustrates the effect of land concentration on stunting for three different values of the share of the agricultural population (when all other variables in the model are kept constant at their means).

Figure 7.1: Effect of Land Concentration, Conditional upon Agricultural Population



Operationalization and Sources: See Section 6.2

The solid line in the middle of the figure shows the effect of land concentration on stunting when the share of the agricultural population is at its mean (53 percent). The dotted line illustrates the effect of land concentration on stunting when the share of the agricultural population is at its minimum (7 percent). If we move from right to left along this line (from high to low land concentration), we see that the expected prevalence of stunting becomes higher as the land distribution becomes more equal. Thus, at these shares of the agricultural population, there is less stunting when land concentration is high. The dashed line (above the solid line) shows the effect of land concentration when the share of the agricultural population is at the maximum value among the countries in this study (92 percent). This line shows that the predicted level of stunting increases when land concentration increases in the context of a very large share of the agricultural population. Consequently, the effect of land concentration is the opposite of when the share of the agricultural population is low. However, the slope of this line is flatter than the two other lines, illustrating that the effect of land concentration is weaker at this share of the agricultural population than at the two lower shares (in the figure). Thus, the effect of land concentration on stunting is negative (the higher land concentration, the lower prevalence of stunting) when the share of agricultural population is low, and positive (the higher land concentration, the higher prevalence of stunting) when the share of the agricultural population is high. The effect of land concentration on stunting changes direction when the share of the agricultural population is about 79 percent (when the level of food availability and all other variables are at their mean).[12] This is a very high share of agricultural population, as only 15 percent of the countries in this study have such high shares.

Furthermore, at an approximately equal land concentration (gini coefficient around 0.0), the predicted prevalence of stunting is approximately the same (+/- six percent) for the three values of the agricultural population. However, it is unlikely that any country will have such a low gini coefficient for landholdings. The lowest gini coefficient among the countries in this study is 0.32. At this level of land concentration, the predicted prevalence of stunting varies from approximately 30

[12] This value should (of course) not be taken as an absolute point of reference, since the model explains about 80 percent of the variation in the prevalence of stunting, and the parameters in the model would be different if all relevant variables were included and/or all variables were correctly operationalized and measured.

percent (when the share of the agricultural population is at its minimum) to about 33 percent (when the share of the agricultural population is at its mean), and further to roughly 48 percent (when the share of the agricultural population is at its maximum). Thus, at the lowest level of land concentration we find in this study, the predicted prevalence of stunting is 18 percentage points higher when the share of the agricultural population is at its highest value, compared to when it is at its lowest.

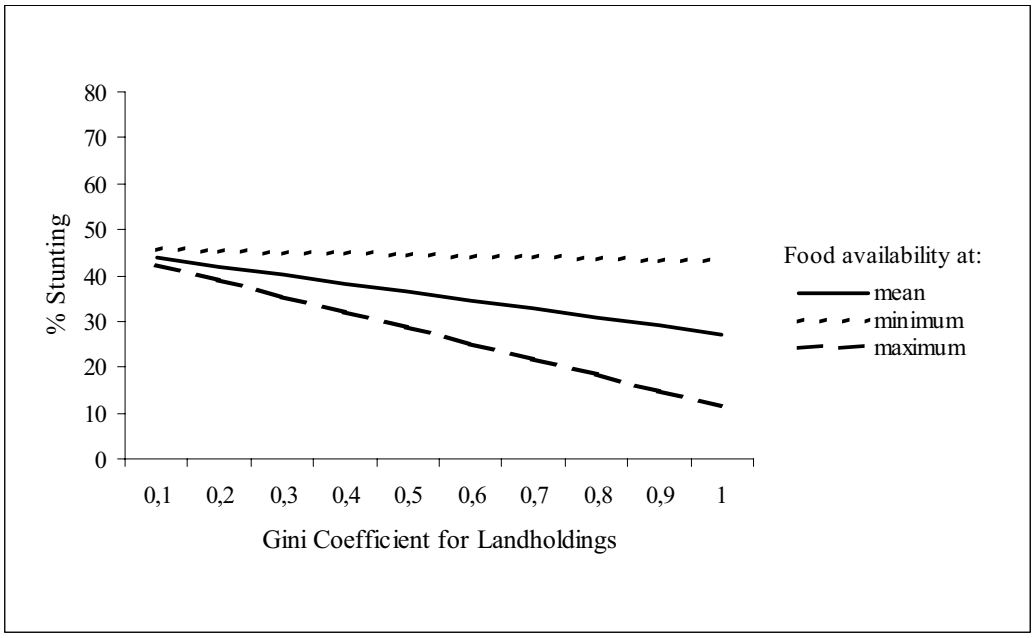
At high levels of land concentration (gini coefficients around 0.9), the predicted value of stunting is still about 27 percent when the share of the agricultural population is at its mean, but the span in the predicted level of stunting from lower to higher shares of agricultural population has widened from 18 percentage points (at a gini coefficient of 0.32) to almost 55 percentage pionts. Thus, at high levels of land concentration, the share of agricultural population matters more for the prevalence of stunting than at low levels of land concentration. It is at high levels of land concentration that we find both the lowest and the highest predicted levels of stunting.

The interaction effect of land concentration and the share of agricultural population illustrated in Figure 7.1 supports the expectation from my theoretical argument that the food insecurity of the non-agricultural population is lower when land concentration is high (because the agricultural surplus available for industrialization is larger when land concentration is high and labor absorption in industry increases). The results depicted in Figure 7.1 also support the expectation that food insecurity among the agricultural population is higher when land concentration is high. Although we do not have direct evidence of this, because the data do not measure food security in these two populations separately, this interpretation is indicated by the finding that high land concentration generates high food insecurity in the total population when the share of the agricultural population (in total population) is high, but low food insecurity when the share of the agricultural population is low.

So far we have only studied how the effect of land concentration interacts with the share of the agricultural population. However, the effect of land concentration also depends on the level of food availability. The interaction effect of land concentration and food availability is illustrated in Figure 7.2. This figure shows the effect of land concentration on the prevalence of stunting for three different

values of food availability (while all other variables in the model are kept constant at their means).

Figure 7.2: Effect of Land Concentration, Conditional upon Food Availability



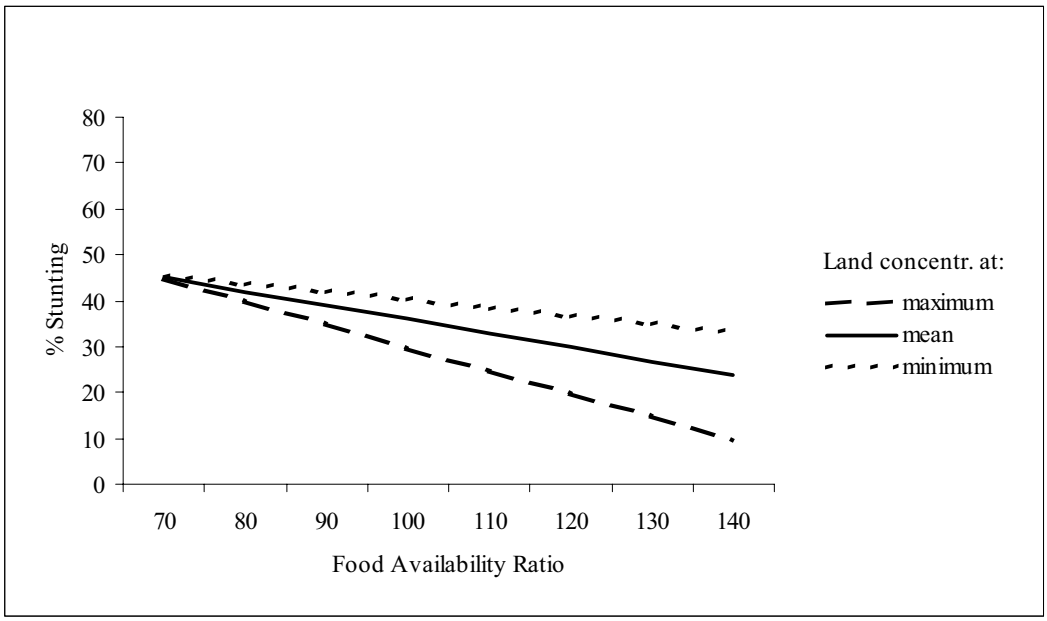
Operationalization and Sources: See Section 6.2

From this figure we can see that the effect of land concentration is negative for all the values of food availability (in this sample). This means that when land concentration increases, the prevalence of stunting is expected to decline. The dotted line shows that the gini coefficient for landholdings has a very weak negative effect on the prevalence of stunting when food availability is at its minimum. At this food availability ratio (73 percent) the predicted prevalence of stunting varies from approximately 45 percent when the gini coefficient is at 0.32 (the lowest in our sample) to about 43 percent when the gini coefficient is at 0.91 (the highest in our sample). From the solid line we see that the negative effect is stronger when the food availability ratio is at its mean (102 percent), compared to when it is at its minimum. From the dashed line we can see that the effect of land concentration is even stronger when the food availability ratio is at its maximum among the countries of this study (130 percent). At this level of food availability, the predicted prevalence of stunting decreases from about 35 percent to about 12 percent when land concentration increases from 0.32 to 0.91. Thus, the negative effect of land concentration is

stronger for higher values of food availability. In addition, we find that when the gini coefficient is at 0.32, the predicted value of stunting is ten percentage points higher when food availability is at its minimum, compared to its maximum. However, when the gini coefficient is at its maximum, the predicted prevalence of stunting is about 30 percentage points higher when the food availability is at the minimum value, compared to when it is at the maximum.

It is easier to understand why we find this relationship from an illustration of how food availability affects stunting at different levels of land concentration. Therefore, I have turned Figure 7.2 around, to plot the conditional effect of food availability. This plot (Figure 7.3) provides the same information as in Figure 7.2, but from a perspective of the effect of food availability.

Figure 7.3: Effect of Food Availability, Conditional upon Land Concentration



Operationalization and Sources: See Section 6.2

Figure 7.3 shows that the effect of the food availability ratio on food insecurity is negative for all values of the gini coefficient (when the food availability ratio increases, the predicted value of stunting goes down). The figure also shows that the effect of food availability is stronger at higher levels of land concentration. When land concentration is at its maximum, the prevalence of stunting is about 40 percent when the food availability ratio is at its lowest (70 percent), and about 15

percent when the food availability ratio is at its highest (130 percent). Thus, the difference in the prevalence in stunting is about 25 percentage points from the lowest to the highest food availability ratio when land concentration is at its maximum. When land concentration is at its minimum, the difference in the prevalence of stunting between the lowest and the highest level of food availability is only about five percentage points.

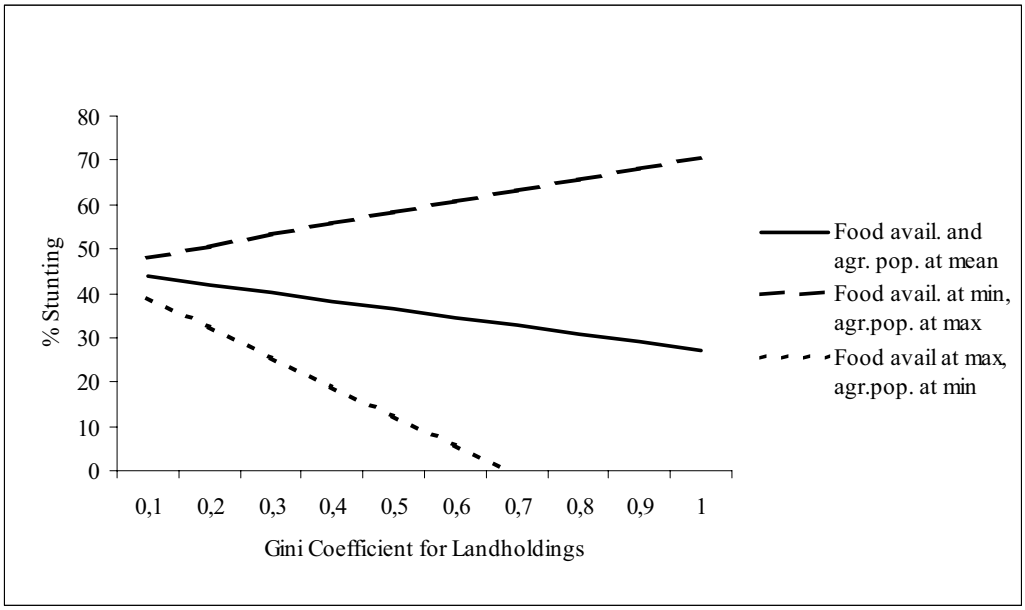
Thus, the effect of the food availability ratio is stronger when land concentration is high.[13] In other words, the price of food is more important for food insecurity when land concentration is high. There are two possible explanations for this. First, when land concentration is high, fewer people have access to agricultural land. Thus, more people are net-buyers of food and rely on the market for their food security (instead of subsistence production). Second, the agricultural population will have low incomes, and therefore be vulnerable to high food prices. How low incomes among the agricultural population affect the prevalence of food insecurity in the total population, however, depends (of course) on the share of the population that depends on agriculture for a living. As explained in Section 6.1 above, I expect to find a three-way interaction effect between land concentration, agricultural population and food availability (and not two separate interactions with land concentration, as modeled, because I have too few cases to include the three-way interaction). However, it is still possible to illustrate how land concentration influences stunting at different combinations of agricultural population and food availability. This is what I have done in Figure 7.4.

From the solid line in Figure 7.4, we see that the gini coefficient for landholdings has a relatively weak negative effect on stunting when both the share of the agricultural population and food availability are at their means. As the gini coefficient increases from 0.32 to 0.91, the prevalence of stunting decreases by 13 percentage points (from 40 to 27 percent). When we have a context where a low share of agricultural population is combined with high food availability, the negative effect from land concentration on the prevalence of stunting is much stronger. If we follow the dotted line (that illustrates this combination) from left to right, we see that the predicted prevalence of stunting decreases from 25 percent when the gini

[13] This is also what we saw in Figure 7.2 that illustrates the relationship from the perspective of the effect of land concentration.

coefficient is 0.32, to 0.0 (no stunting at all) when the gini coefficient is just above 0.6.[14] This is in stark contrast to the predicted value of stunting at this (high) gini coefficient in the very unfavorable context of a high share of the agricultural population and low food availability. When all of these unfavorable conditions coincide, we see from Figure 7.4 that the prevalence of stunting is expected to be about 70 percentage points. Thus, when land concentration is at its highest, the difference in predicted prevalence of stunting between the most favorable and the most unfavorable context of agricultural population and food availability is approximately 70 percentage points! At the lowest gini coefficient in the sample of this study (0.32), the divergence between these two contexts is only about 30 percentage points. Thus, the share of the agricultural population and level of food availability matters most for food insecurity where landholdings are highly concentrated.

Figure 7.4: Effect of Land Concentration for Three Combinations of Agricultural Population and Food Availability



Operationalization and Sources: See Section 6.2

These findings (illustrated in Figure 7.4) are consistent with the theoretical expectations discussed in Section 6.1 (and illustrated in Figure 6.1). For instance, the combination of a high level of land concentration, low level of food availability, and

[14] It is unlikely that the prevalence of stunting in any country will be zero in the "real world".

a high share of agricultural population gives high food insecurity because: 1) the high level of land concentration will probably result in low incomes for the agricultural population; 2) low food availability will most likely lead to high food prices; 3) the combination of low incomes and high food prices leads to a high prevalence of food insecurity (in the agricultural population); and 4) when there is a large share of agricultural population (in the total population), the high food insecurity level in the agricultural population translates into a high prevalence of food insecurity in the total population.

On the other hand, the combination of high land concentration, high food availability and a small share of agricultural population gives low levels of food insecurity because: 1) when land concentration is high, incomes among the industrial population will most likely be high; 2) high food availability will probably give low food prices; 3) the combination of a high income level and low food prices gives a low prevalence of food insecurity among the industrial population; and 4) when the industrial population constitutes a large share of the total population (the share of agricultural population is small), the low food insecurity rates in the industrial population translate into a low prevalence of food insecurity in the total population.

In summary, the analyses in this section have shown that the level of land concentration influences food insecurity, and that the strength and direction of this influence change with two contextual factors: 1) the share of the agricultural population; and 2) the food availability ratio. Land concentration has a strong negative effect on food insecurity (food insecurity is expected to decline sharply when land concentration increases) when there is a small share of the population that depends on agriculture for a living, and/or the food availability level is high. When the food availability ratio is low, the negative effect of land concentration is weaker. Land concentration has, on the other hand, a (weak) positive effect on food insecurity (we anticipate a rise in food insecurity when land concentration increases) when a large share of the population depends on agriculture for a living.

We have also seen that food availability has a negative effect on the prevalence of stunting and that the strength of the effect depends on the level of land concentration. The negative effect of food availability is strongest at high levels of land concentration. Furthermore, we saw from the standardized regression coefficients that the conditional effect of land concentration and food availability is

stronger than the conditional effect of land concentration and the share of the agricultural population.

In this section I have only tested the direct effects on food insecurity. As may be recalled from Figure 6.2, I also anticipate that land concentration and agricultural labor productivity have indirect effects on food insecurity. In the following section I test these relationships.

7.2 Indirect Effects on Food Insecurity

The purpose of this section is to test the anticipated indirect effects on food insecurity. We can recall from the model of food insecurity sketched in Figure 6.2, as well as the more general conceptual scheme (illustrated in Figure 5.1.c), that I expected agricultural labor productivity to influence food insecurity both directly, and indirectly (via food availability). The above analysis showed that agricultural labor productivity does not have a direct effect. However, food availability has a relatively strong direct effect on food insecurity in interaction with land concentration (we saw this from the conditional effect plot in Figure 7.3). Thus, it is still possible that agricultural labor productivity can have an indirect effect on food insecurity via food availability. In addition, I expected land concentration to have an indirect effect on food insecurity via both agricultural labor productivity and food availability.

Thus, in the first part of this section (Sub-Section 7.2.1) I will investigate the effects of land concentration and agricultural labor productivity on food availability. As we find that agricultural labor productivity influences food availability, the second Sub-Section (7.2.2) will investigate the relationship between land concentration and agricultural labor productivity.

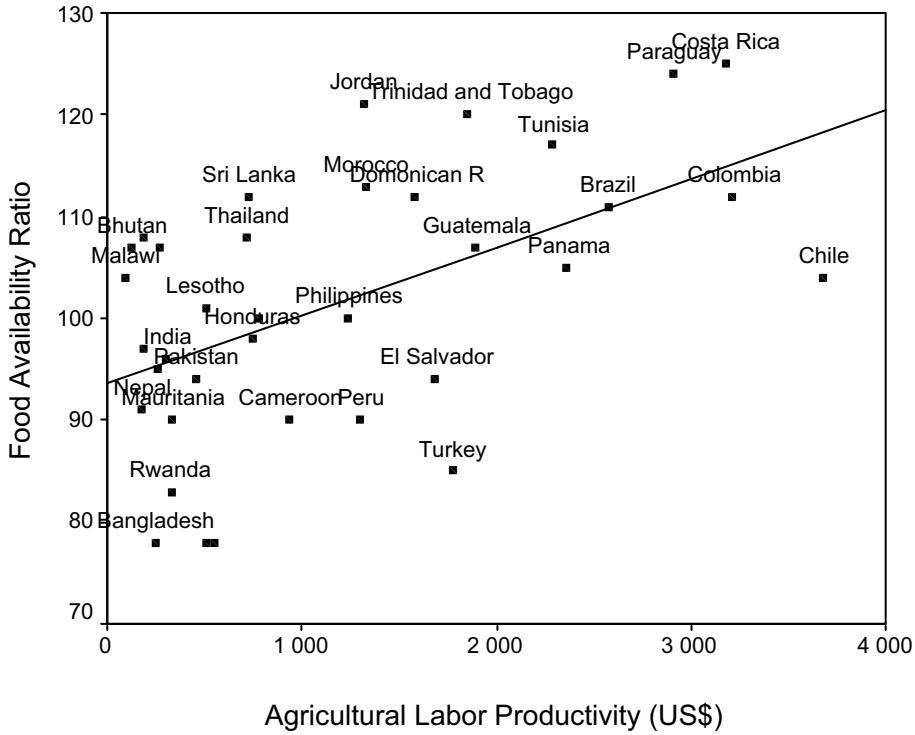
7.2.1 Effects via Food Availability

The first step in unraveling the indirect effects on food insecurity is to study whether agricultural labor productivity and land concentration affect food availability. The regression analysis above (in Section 7.1) revealed that food availability influences food insecurity in interaction with land concentration, but that food availability does not have an independent effect on food insecurity. The purpose of this analysis is to test whether there are indirect effects from land concentration and agricultural labor

productivity on food insecurity via food availability (that is part of the interaction variable).

I expect to find a positive correlation between agricultural labor productivity and the food availability ratio, because when each worker can produce more, it should result in more food per capita. In Figure 7.5 we see that there is a strong and positive relationship between labor productivity in agriculture and food availability. The "Pearson's r" is 0.534 and the p-value is 0.001.[15]

Figure 7.5: Agricultural Labor Productivity and Food Availability

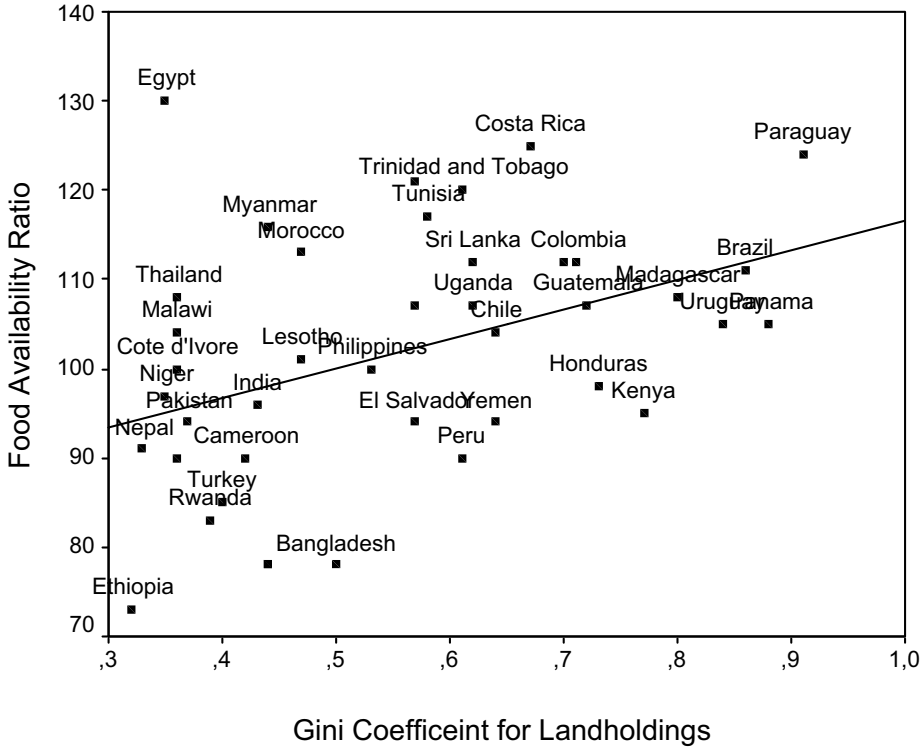


Note: Pearson's r = 0.534, p-value = 0.001
Operationalization and Sources: See Section 6.2

[15] The two outliers, Egypt (with a food availability ratio of 130 and a labor productivity level of only 853 US$) and Uruguay (with a labor productivity level of 6,537 US$ and a food availability ratio of only 105), are not included in the figure because it is hard to see variation among the other countries, as well as their names, when they are included. The two countries are furthermore not included in the estimation of the "Pearson's r" because they have a large influence on the parameters. When both countries are included, the "Pearson's r" is much lower (0.383 with a p-value of 0.017). When only Uruguay is excluded, the "Pearson's r" is 0.481 with a p-value of 0.003. When only Egypt is excluded the "Pearson's r" is 0.431 and the p-value 0.008. Thus, Egypt pulls the strength of the relationship down a little more than does Uruguay.

In Chapter 5 we discussed how it is probable that land concentration affects the total availability of food because it influences both the type of crops grown and agricultural labor productivity. I expected large farms to produce more cash crops (such as coffee, tea, etc), and have lower levels of self-consumption. I do not have data on the extent of the export of agricultural products, or on imports of food. Nor do I have data to measure whether non-food and export crops constitute a higher share of agricultural production when land concentration is high. I can only test the relationship between land concentration and food availability (directly). Thus, I expect to find a negative correlation between land concentration and food availability.

Figure 7.6: Land Concentration and Food Availability



Note: Pearson's r = 0.512, p-value = 0.001
Operationalization and Sources: See Section 6.2

In Figure 7.6 we see that there is a positive relationship between land

concentration and food availability. For this relationship, the "Pearson's r" is 0.512 and the p-value is 0.001.[16]

The positive correlation is contrary to my expectation. To find out whether these two (bivariate) correlations translate independent, positive, effects on food availability, I will perform a multivariate regression analysis. As it is easier for "rich" countries to import food than for poor countries, the level of GDP per capita might also influence the food availability ratio.[17] As there is collinearity between agricultural labor productivity and GDP per capita (the correlation between them is 0.811), there is hardly any independent variation in these two variables, and one of them should be excluded (Hamilton 1992: 82). Since agricultural labor productivity is the theoretically interesting variable, I will not include GDP per capita in the regression analysis.

I also expected to find that civil war would affect food availability, as it can disrupt the production of food (even though it did not have a direct effect on food insecurity). Instead, I found a very weak bivariate relationship between civil war and the food availability ratio (the "Pearson's r" is only–0.195 with a p-value of 0.221[18]), as well as between civil war and agricultural labor productivity and land concentration. Thus, I will not include civil war in the regression analysis.

The result of this regression analysis of the effects of land concentration and agricultural labor productivity is shown in Table 7.3. From this table we see that the model explains (only) about 36 percent of the variation in the food availability ratio. In addition, we can see that agricultural labor productivity has a positive effect on food availability, with a standardized coefficient of 0.345 and a p-value of 0.048. This is in line with the expectation that when agricultural workers produce more, there will be more food (per capita) in the country.

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[16] Egypt is not included in the figure because it has a very high food availability ratio (130 percent), and its inclusion makes it hard to see variation among the rest of the countries (as well as the country labels). Egypt is also excluded from the estimation of the "Pearson's r". When Egypt is included, the "Pearson's r" is 0.414, with a corresponding p-value of 0.007. Thus, Egypt is an outlier with relatively high influence on the correlation coefficient.

[17] The correlation between GDP per capita and the food availability ratio is 0.477 with a p-value of 0.002. When the outlier Egypt is excluded, the correlation increases to 0.524, with a p-value of 0.001.

[18] The p-value for land concentration is 0.55, and therefore slightly above the significance level of 0.05 set for this study. However, since land concentration is such an important variable in the theoretical foundation of the model, I have chosen to keep it.

Table 7.3: The Effect of Land Concentration and Agricultural Labor Productivity on Food Availability

	Unstandardized coefficients (B)	Standardized Coefficients (Beta)	P-value
Constant	82.017		0.000
Gini for Landholdings	25.699	0.334	0.055
Agricultural Labor Productivity	0.00435	0.345	0.048

Note: R^2 = 0.361, N = 36
Operationalization and Sources: See Section 6.2

Table 7.3 also documents that land concentration has an independent positive effect on food availability, with a standardized regression coefficient of 0.334 and a p-value of 0.055.[19] This means that countries with high land concentration have higher food availability than countries with low land concentration (the predicted level of food availability increases as the distribution of landholdings get more concentrated). This effect comes on top of the eventual effect that land concentration has on agricultural labor productivity, and thus contradicts the expectation that this independent effect should be negative (because large farms would produce non-food and export crops instead of food for the domestic market). To interpret this discrepancy, we should recall how higher levels of land concentration might be beneficial for industrial growth (because the agricultural surplus is probably higher when concentration is high). Thus, it is possible that the positive effect of land concentration on food availability can be traced to higher industrialization—which generally means higher GDP per capita (because labor productivity is higher in industry than in agriculture)—and further to greater food imports. The relatively high correlation of 0.521 (with p-value 0.001) between land concentration and GDP per capita supports this interpretation. However, we do not have enough information to measure the import effect of a high GDP per capita. Consequently, we are left to speculate about why land concentration leads to higher food availability, even when we have controlled for the eventual effect of land concentration on agricultural labor productivity.[20]

In this section we have studied the relationships between land concentration, labor productivity, and food availability. The results of these analyses indicate that

[19] The outliers Egypt (food availability) and Uruguay (labor productivity) are not included.

[20] Since the R^2 of the model is as low as 0.36, it is also possible that this effect could be negative if all relevant variables were included.

high agricultural labor productivity is important for food availability. They further indicate that high land concentration is associated with high food availability (regardless of its relationship with agricultural labor productivity). However, civil war does not appear to affect food availability.

There is one last indirect effect from land concentration on food insecurity that has yet to be discussed. This is the possible effect that goes via agricultural labor productivity. We will now turn to an analysis of this relationship.

7.2.2 Effects via Agricultural Labor Productivity

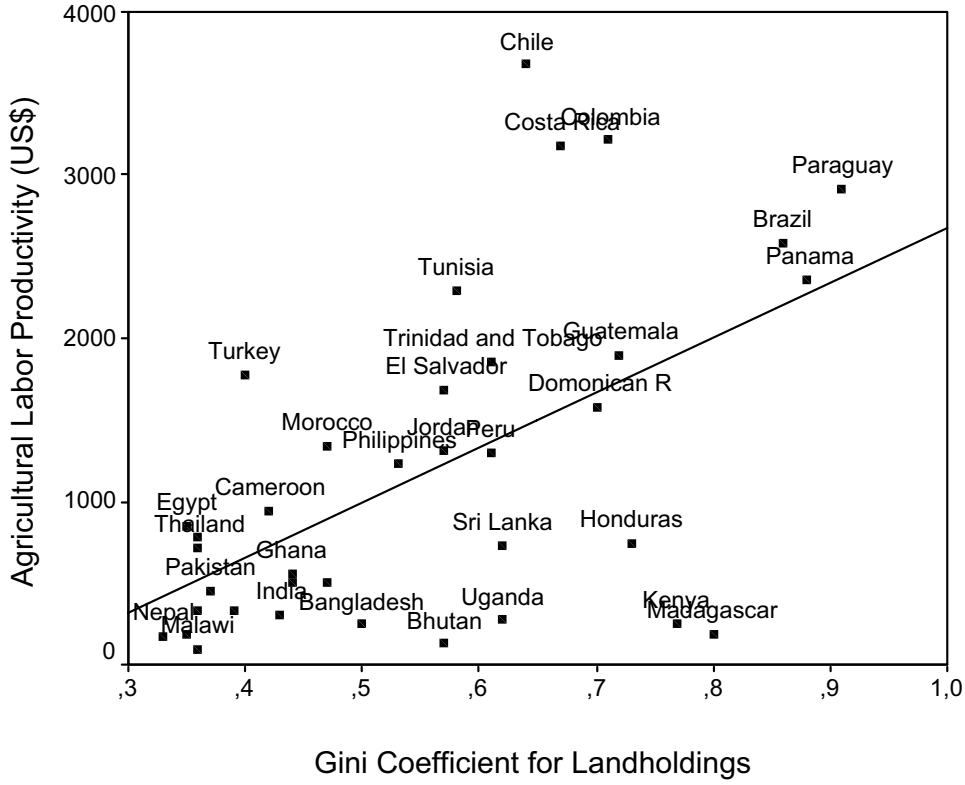
The regression analysis in the last sub-section showed that agricultural labor productivity has a positive effect on food availability. In addition, we learned in Section 7.1 that food availability has a direct effect on food insecurity (in interaction with land concentration). In this sub-section I analyze the relationship between land concentration and labor productivity in agriculture. The purpose of this analysis is to find out whether land concentration also influences food insecurity via an effect on agricultural labor productivity.

We may recall from Section 5.3.1 that agricultural labor productivity is the product of land productivity and the land/labor ratio. We can further recall that I expect land concentration to influence agricultural labor productivity primarily through the land/labor ratio, and possibly also through land productivity. In this section I will first examine the overall relationship between land concentration and agricultural labor productivity. I will then break down the overall relationship into two distinct parts, studying the relationship between land concentration and 1) the land/labor ratio; and 2) the level of land productivity. Finally, I will study the relative influence of the land/labor ratio and land productivity on agricultural labor productivity. Together, these separate analyses will give us an idea of whether, and in that case how, land concentration affects labor productivity in agriculture.

The theoretical discussion in Chapter 5 revealed that there is some uncertainty about the relationship between land concentration and agricultural labor productivity. This uncertainty has its roots in divergent theoretical expectations about how land concentration affects land productivity (which is one of the two factors in labor productivity). The correlation analysis illustrated in Figure 7.7 indicates that the

relationship between land concentration and agricultural labor productivity is positive. The "Pearson's r" for this correlation is 0.584 (with a p-value of 0.000).[21]

Figure 7.7: Land Concentration and Agricultural Labor Productivity



Note: Pearson's r = 0.584, p-value = 0.000
Operationalization and Sources: See Section 6.2

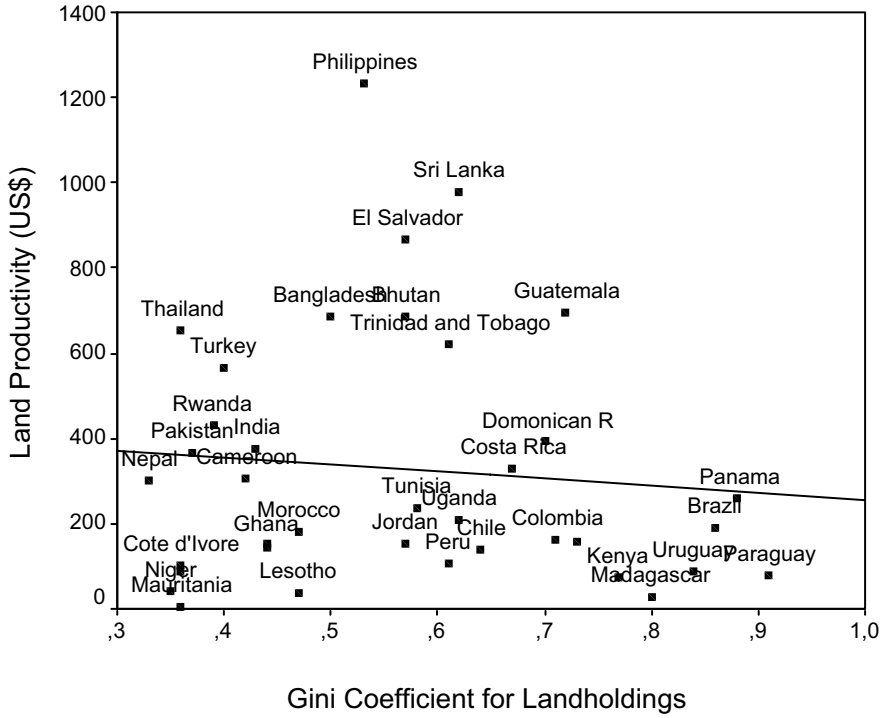
This means that countries with high land concentration have higher levels of agricultural labor productivity.[22] In the lower left-hand corner of the figure we find most of the Sub-Saharan and South Asian countries. The countries in the center of the figure, which have medium values on both variables, are mostly a mix of countries from Latin American and the Near East and North African countries. Once

[21] Uruguay is excluded from the figure, because it has a labor productivity score of 6,537 US$. When Uruguay is included, most other countries group so close together that I can show very few of their names. However, Uruguay is included in the estimation of "Pearson's r". When the country is excluded, the coefficient decreases only slightly (to 0.561 with p-value 0.000). Thus, Uruguay is only a figurative outlier, but does not have too large an influence on the estimates.

[22] I have tested whether civil war influences labor productivity by including land concentration and civil war in a multivariate regression analysis. Civil war doesn't have an effect (the beta coefficient is 0.032 with a p-value of 0.822, and the R^2 is the same as when only land concentration is included.

again, a group of Latin American countries stand out, now with high levels of agricultural labor productivity. Some of these countries, like Paraguay, Brazil, and Panama also have very high gini coefficients for land holdings.[23] Chile, Costa Rica and Colombia are separated from the rest of the Latin American countries (as well as all the other countries) in Figure 7.7, with relatively low gini coefficients combined with the highest levels of labor productivity. From Figures 7.8 and 7.9 we can see that Chile has a relatively low land productivity level, but much higher land/labor ratio than the other countries (except Paraguay and Brazil). Thus, a high land/labor ratio can explain Chile's high agricultural labor productivity level. Colombia and Costa Rica have medium values for both land productivity and the land labor ratio, which combines with the second and third highest levels of labor productivity.

Figure 7.8: Land Concentration and Land Productivity



Note: Pearson's r = - 0.096, p-value = 0.571
Operationalization and Sources: See Section 6.2

[23] Although absent from the illustration, Uruguay (with a labor productivity of 6,537 US$ and a gini coefficient of 0.84) is also included in this group.

Following the dispute about the relationship between land concentration (or, more correctly, the size of farms) and land productivity in the literature,[24] I do not have a clear expectation about the direction or strength of this relationship. Indeed, from the scatter plot and regression line in Figure 7.8, we see that there is practically no relationship between land concentration and land productivity. This is confirmed by a "Pearson's r" of –0.096, with the corresponding p-value of 0.571.[25]

This result indicates that the Inverse Relationship Theory (discussed in Sub-Section 5.3.2) receives little support in this sample. Insofar as countries with low levels of land concentration generally have smaller farms than countries with high levels of land concentration, the inverse relationship between farm size and land productivity should materialize into a (strong and significant) negative relationship between land concentration and land productivity. This relationship was not found. The lack of any clear relationship between land concentration and land productivity can be a consequence of the deteriorating land productivity on small farms over time. In this case, some countries with low levels of land concentration may have come farther down the path of over-intensive land use than others, and this could explain why the relationship appears unclear.

I expect, however, that there is a positive correlation between land concentration and the land/labor ratio, as I expect small farms to have lower land/labor ratios than large farms. From Figure 7.9 we can see that this expectation is supported. There is a relatively strong positive correlation between land concentration and the land/labor ratio, with a "Pearson's r" of 0.623 and a p-value of 0.000.[26]

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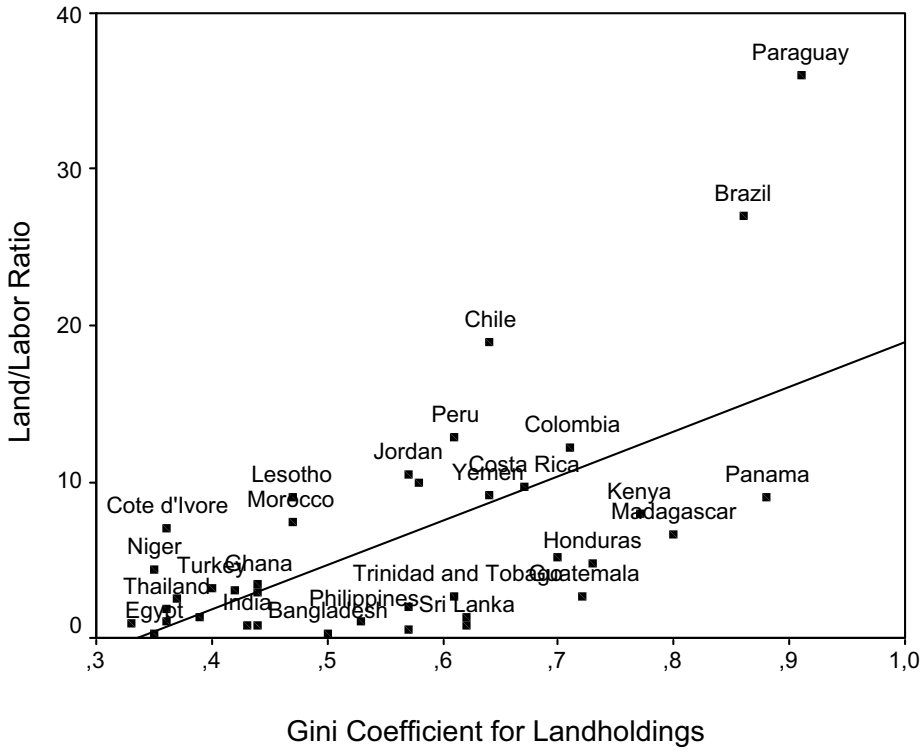
[24] According to the "Inverse Relationship Theory", land productivity is higher on small farms, mainly because labor intensity is higher (and fallows are shorter). This position is contested by the argument that large farms have more resources to invest in land-saving technologies such as fertilizers, pesticides, herbicides, and irrigation (as well as labor-saving technology such as tractors), so that they can achieve just as high, or higher, land productivity levels with less labor (higher land/labor ratio) than the small farms. See Sub-Section 5.3.2.

[25] When the outlier Egypt is included in the estimation, the Pearson's correlation coefficient moves to –0.221, with a corresponding p-value of 0.183.

[26] Neither Uruguay nor Mauritania is included in Figure 7.9 (or the estimation of "Pearson's r") because they have a much higher land/labor ratio than the other countries. Uruguay has a land/labor ratio of 77.16, combined with a gini coefficient of 0.84; and Mauritania has a land/labor ratio of 77.11, and a gini coefficient of 0.36. Both countries have high influence on the estimation of the "Pearson's r" correlation coefficient. When both countries are included, the "Pearson's r" is 0.300 with a p-value 0.060. When only Mauritania is excluded (and Uruguay is included), the "Pearson's r" is reduced to 0.553, with p-value 0.000. When only Uruguay is excluded (and Mauritania is included) the

A regression analysis of the effects of the land/labor ratio and land productivity on agricultural labor productivity reveals that the land/labor ratio has by far the strongest effect on agricultural labor productivity (the standardized regression coefficient are 0.578 with p-value 0.000, and 0.076 with p-value 0.610, respectively). Since land concentration has a relatively strong positive correlation with the land/labor ratio, but no clear correlation with land productivity, the positive effect of land concentration on agricultural labor productivity (illustrated in Figure 7.7) must go through the land/labor ratio.

Figure 7.9: Land Concentration and the Land/Labor Ratio



Note: Pearson's r = 0.623, p-value = 0.000
Operationalization and Sources: See Section 6.2

It is unlikely that land concentration has much influence on the total amount of agricultural land. However, large farms need less labor per hectare because they can produce the same amount with less labor (at lower cost than if technology was

"Pearson's r" is 0.174 and the p-value 0.288. Thus, the outliers pull the relationship in opposite directions, while Mauritania has the strongest influence of the two countries. The correlation between the gini coefficient for landholdings and the logarithm of the land/labor ratio, including outliers (which is closer to the normal distribution than the raw data variable), has a "Pearson's r" of 0.495 with a p-value of 0.001.

substituted for labor). Small farms employ more labor because they have (per definition) little land, and need to cultivate intensively—while they do not have access to labor-saving technology. Small farms may also choose to employ more labor instead of labor-saving technology because family members otherwise would be unemployed, and the cost of extra labor is therefore low compared to the cost of labor-saving technology. When land concentration is high, there is probably less work to be found in agriculture, and more people are forced to find work outside the agricultural sector. Thus, it seems probable that land concentration influences agricultural labor productivity via the land/labor ratio because high levels of land concentration pushes people to seek work outside of agriculture, and thereby reduces the size of the agricultural labor force.

On the other hand, the reason could also be that the countries with high land concentration have a high level of industrialization (and corresponding high level of labor absorption in industry), and that the agricultural labor force has been reduced by a pull from jobs in the industrial sector. Insofar as this high level of industrialization is facilitated by high labor productivity, finding the cause of the high land/labor ratio in countries with high land concentration will be much like asking which came first, the chicken or the egg. Nevertheless, it is probable that high land concentration is the basic condition that spurred this spiral effect.

In this sub-section we have seen that there is a positive relationship between land concentration and agricultural labor productivity. Hence, the analysis confirms my expectation that land concentration also influences food insecurity indirectly, via agricultural labor productivity (as illustrated in Figure 6.2). We have further seen that the relationship between land concentration and agricultural labor productivity goes via the land/labor ratio.

The purpose of this section has been to test two sub-models in order to unveil the indirect effects in the model of food insecurity. In summary, we have seen that land concentration affects food availability and agricultural labor productivity (via the land/labor ratio). We have also seen that agricultural labor productivity influences food availability. Thus, land concentration affects food availability both directly and indirectly via agricultural labor productivity. It is now time to tie these relationships together with the direct effect on food insecurity. This is the purpose of the following section.

7.3 A Revised Model of Food Insecurity

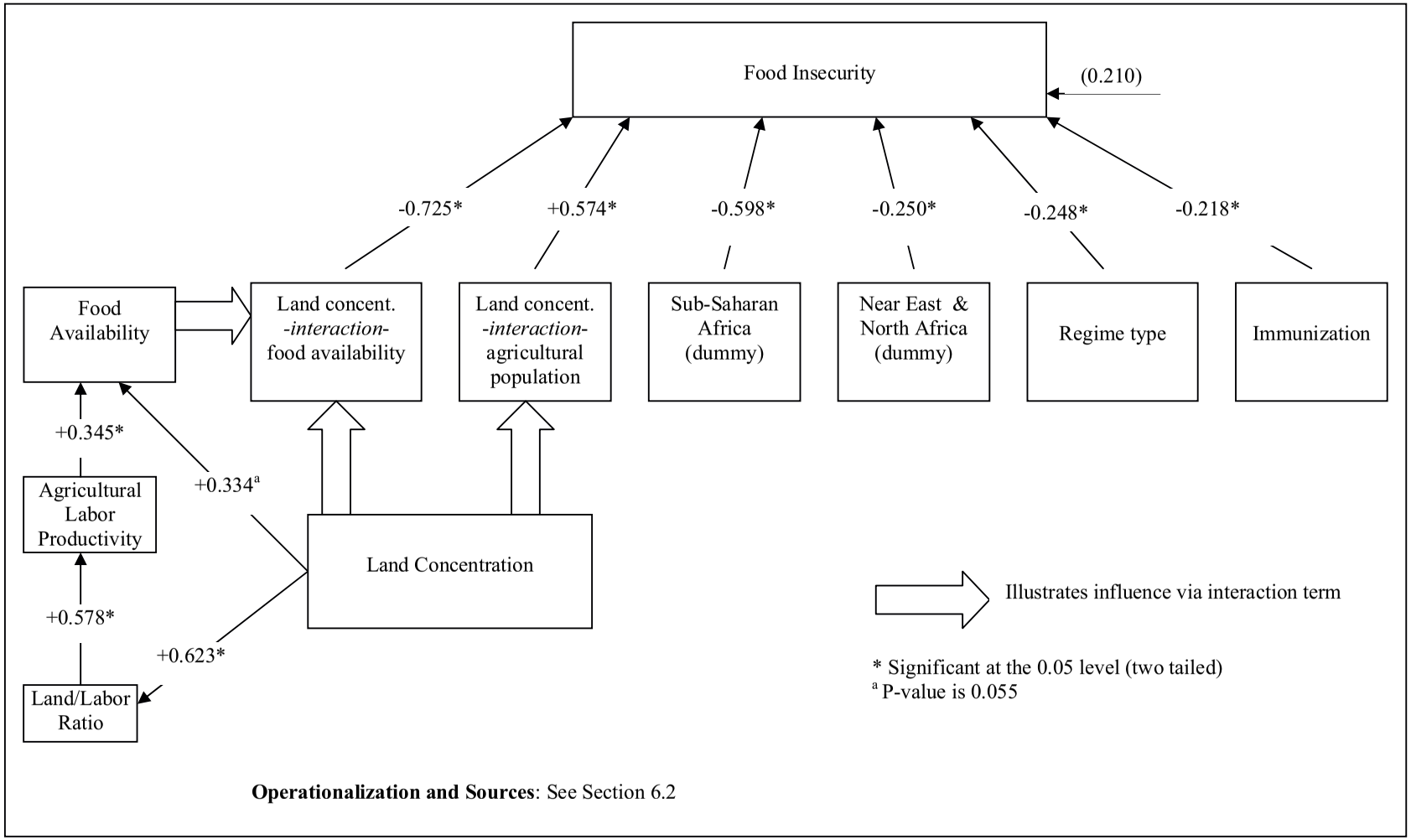
The previous section analyzed the effect of land concentration on agricultural labor productivity, and the effect of land concentration and labor productivity on food availability. In this section I will graphically depict how these relate to the direct effects on food insecurity that we found in Section 7.1 (see Table 7.2). In doing so, these effects can be understood as indirect effects on stunting. As the food availability ratio does not have an independent effect on food insecurity, but only an interaction effect with land concentration—and agricultural labor productivity does not have a direct effect—I cannot perform a "formal" path-analysis (where the indirect effects can be calculated). Therefore, I will analyze how the indirect effects are linked to stunting in a qualitative manner, using the *informal* illustration of the effects in Figure 7.10 as a guide.[27]

Figure 7.10 depicts the modified version of the food insecurity model for developing countries (modified from Figure 6.2) that I have tested (step-by-step) in Sections 7.1 and 7.2. From the figure we can see that the interaction between the gini coefficient for landholdings and the share of the agricultural population has a positive direct effect on the prevalence of stunting. Thus, the higher the values of this interaction term, the higher the predicted prevalence of stunting. Furthermore, the interaction between the gini coefficient for landholdings and the food availability ratio, the dummy variable for Sub-Saharan Africa, the dummy variable for the Near East and North Africa, regime type and immunization all have negative direct effects on stunting. This means that higher values on these variables give lower predicted values of stunting.

We can also see from Figure 7.10 that the gini coefficient for landholdings has a positive effect on agricultural labor productivity (via the land/labor ratio), and thereby an indirect positive effect on food availability. Land concentration and agricultural labor productivity also affect the food availability ratio in a direct, positive, manner. This means that high levels of land concentration, and high agricultural labor productivity, are associated with high levels of food availability.

[27] Since the R^2 is low for both agricultural labor productivity and food availability the coefficients on these variables may be inaccurate.

Figure 7.10: A Revised Model of Food Insecurity in Developing Countries



As illustrated in Figure 7.3, the direct effect of food availability is negative for all values in the sample of this study. In addition, the food availability ratio interacts with the gini coefficient for landholdings in such a way that it always has a negative effect on food insecurity, but the effect is stronger when the gini coefficient for landholdings is high. Thus, all the positive effects from the gini coefficient for landholdings and agricultural labor productivity to food availability translate into a negative effect on stunting[28] (they contribute to a reduction in stunting), and they will be stronger when land concentration is high (compared to when land concentration is low).

7.4 Summary

The purpose of this chapter has been to test empirically the causal relationships in the testable model of food insecurity (see Figure 6.2), originally derived from the conceptual scheme that was drawn up in Chapter 5 (see Figure 5.1a to 5.1.c).

Before we summarize the results, I would like to recall several sources of error that should be kept in mind. First, the indicator for food insecurity, the prevalence of stunting, is measured in percent of the population of children below five years of age. Thus, the data may not be representative for the total population of the countries. Also, disease may influence the prevalence of stunting in addition to inadequate access to food. Despite the inclusion of immunization rates and the percent of population with access to improved water source and sanitation facilities, we may not have been able to control for the effect of disease. Furthermore, I had to modify the model of food insecurity in accordance with the availability of data. Thus, all relevant variables could not be included. Although the two regional dummies were included to try to control for some of the variables without data, the estimates will still be influenced by omitted variables. However, the coefficient of variation (R^2) is relatively high (0.790). This indicates that the model is relatively well specified, and that omitted variables may not represent too serious a problem. In addition, there is (of course) the general problem with comparability of data across developing countries, and between data collected by different international organizations. On top of all this, the sample of the study is relatively small (41), which can make

[28] At least within the range of the food availability ratio in this study, which is from 73 percent to 130 percent.

generalizations problematic. Thus, I have reported the p-value on all the estimated coefficients.

I tested the model of food insecurity in two stages. In the first stage I studied the direct effects on food insecurity in a series of multivariate regression analyses. The result of these analyses indicated that:

1) The interaction between land concentration and the share of the agricultural population has a relatively strong positive (direct) effect on food insecurity;
2) The interaction between land concentration and food availability has a relatively strong negative (direct) effect on food insecurity;
3) There is no direct independent effect from land concentration (because the direct effect of land concentration on food insecurity in the total population depends on the share of the agricultural population and food availability ratio);
4) There is no direct independent effect from food availability on food insecurity (because the effect of food availability depends on the level of land concentration);
5) Agricultural labor productivity does not have a direct effect on food insecurity (probably because of the multicollinearity problem);
6) The dummy variables for Sub-Saharan Africa and the Near East and North Africa (that I assume capture lower landlessness and less tenure in these regions compared to Latin America and the Caribbean and South East Asia) have negative effects on food insecurity (which means that the specific aspects that these dummies capture lead to lower food insecurity than the model otherwise would predict);
7) The control variable for regime-type has a weak negative effect (which means that more democratic states have less food insecurity), and the control variable for immunization has a weak negative effect on food insecurity (which means that there is less stunting where more children are immunized); and
8) The control variables for GDP per capita, civil war, and access to improved water and sanitation facilities do not have any effect on stunting.

I used conditional effect plots to interpret the interaction effects between land concentration, the share of the agricultural population, and the food availability ratio.

The first of these plots illustrated that land concentration has a negative effect on food insecurity when the share of the agricultural population is small, and a positive effect when the share of the agricultural population is large. This means that high levels of land concentration produce low levels of food insecurity when the share of the agricultural population is small, but high food insecurity levels when the share of the agricultural population is large.[29]

The second plot, depicting the interaction effect of land concentration and food availability, demonstrated that land concentration has a negative effect on food insecurity for all values of food availability, but that the negative effect is stronger at higher levels of food availability. Thus, high levels of land concentration combined with low levels of food availability lead to higher levels of food insecurity than high levels of land concentration combined with high levels of food availability. A third plot, that illustrated the same relationship from the perspective of food availability, showed that food availability has a negative effect on food insecurity for all levels of land concentration, but that the effect is much stronger when land concentration is high.

Last, but not least, I included an illustration of the effect of land concentration at three combinations of the share of agricultural population and food availability. From this illustration we could see that high land concentration leads to very high levels of food insecurity in the context of a large share of agricultural population and a low food availability ratio. However, when high land concentration is combined with a low share of agricultural population and a high food availability ratio, there will be very low (or no) food insecurity. The illustration further showed that we will find both the highest and the lowest prevalence of stunting where land concentration is high, and that the outcome depends on the context of the share of agricultural population and food availability.

The second stage of the tests was aimed to study the indirect effects of land concentration and agricultural labor productivity on food insecurity (via agricultural labor productivity and food availability). The results of these tests indicate that:

[29] In this sample, the effect of land concentration changed direction when the share of the agricultural population was approximately 79 percent. Hence, when the share of the agricultural population was less than 79 percent, high land concentration had a negative effect, and vice versa (when the food availability ratio was at its mean).

1) Land concentration has a negative indirect effect on the prevalence of stunting via its positive effects on agricultural labor productivity and the food availability ratio (thus via this mechanism a high level of land concentration gives low food insecurity); and
2) Agricultural labor productivity has a negative indirect effect on stunting, through its positive effect on the food availability ratio (which means that high labor productivity leads to less food insecurity).

At the end of these analyses, I merged the effects on agricultural labor productivity and food availability with the direct effects on food insecurity. This combination resulted in an "informal" path-diagram that illustrates the direct and indirect effects on food insecurity. This path diagram represents a modified model of food insecurity in the developing world, and shows that the relationship between land concentration and food availability (on the one side) and food insecurity (on the other) is quite complex.

The most important result of these analyses is that land concentration influences food insecurity in different ways according to the context of the share of agricultural population and the food availability ratio. This finding is important because it has implications for the potential effect of land reform policies. I will discuss these policy implications in the concluding chapter, to which we now turn.

8

Conclusion

The main purpose of this thesis has been to assess land reform's potential for reducing food insecurity in developing countries. A subordinate objective has been to show that food availability influences entitlements to food. In pursuing these aims, this thesis has discussed alternative approaches to the study of food insecurity, and different ways to measure the extent of the problem. It has also described the state of food insecurity and land concentration across the developing world. Furthermore, this thesis has provided a conceptual scheme for understanding how land concentration and food availability affect food insecurity. Finally, it has investigated the empirical relationship between land concentration, food availability and food insecurity across the developing world, by way of a cross-country, multivariate regression analysis of a carefully specified model of food insecurity. The results of these analyses are reviewed in the following section. In the section thereafter, I discuss the policy implications of these results. The chapter ends with suggestions for further research that can shed additional light on what can be done to reduce the overwhelming problem of food insecurity in the developing world.

8.1 Main Results of the Study

The most interesting results are those that concern how land concentration and food availability relate to the poor's access to food. However, before we discuss these results, and their implications, I would like to recall a few less central, but still important, findings.

The first of these findings is that more democratic countries have a weak tendency to enjoy less food insecurity (than less democratic countries). This provides some support to Sen's (and others') argument that popular participation compels governments to implement redistributive policies conducive to food security. Another interesting but tangential result is that immunization reduces the prevalence of stunting. This would appear to be because immunization interferes with the reciprocal interaction between inadequate access to food and disease that results in stunted growth. The three additional control variables that were included in the

model (GDP per capita, civil war and access to improved water and sanitation) did not show a significant effect.

Furthermore, the results of the study showed that regional characteristics associated with the Near East and North Africa, and with Sub-Saharan Africa, lead to lower food insecurity. We can't be certain about the nature of these regional characteristics, only that they are not captured by other variables in the model. Nevertheless, it is probable that lower landlessness and less tenancy in Sub-Saharan Africa and the Near East and North Africa (compared to Latin America and the Caribbean, and South East Asia) can explain at least some of these effects. Labor productivity in agriculture did not show an effect; probably because it showed multicollinearity with the variables in the first, as well as the final, model. The effect of agricultural labor productivity is thus captured by the other variables (primarily land concentration, the share of agricultural population, and food availability). In fact, the results of the study indicate that high levels of land concentration lead to higher levels of labor productivity in agriculture, and to higher levels of food availability. While high labor productivity levels also result in high levels of food availability, high food availability levels reduce the level of food insecurity (in interaction with land concentration).

The most important findings in the empirical analysis are two. First, the effect of land concentration on food insecurity depends on the share of agricultural population in such a way that high levels of land concentration in combination with a large share of agricultural population produces high levels of food insecurity. Alternatively, in those countries where high levels of land concentration are combined with a small share of agricultural population, the level of food insecurity will be low. The reason that high levels of land concentration lead to high levels of food insecurity when the share of the agricultural population is high, is straightforward. People relying on agriculture for a living will have better access to food when they have land on which they can grow their own food (than when they have to rely on employment on large farms for income, and the market for food). Thus, in a situation where land is highly concentrated and where a large share of the population depends on agriculture for a living, a large share of the total population will not have access to enough food. The remaining population that relies on industry for their living, will—on the other hand—be more food-secure when the level of land

concentration is high. This is because there will be a larger agricultural surplus, higher industrial growth, and higher growth in non-agricultural employment. Thus, if only a small share of the total population depends on agriculture in a country with a high level of land concentration, the prevalence of food insecurity in the total population will be low, despite the fact that there is a high level of food insecurity in the agricultural population.

A low level of land concentration, on the other hand, produces a medium (not a low) level of food insecurity. This is the result of two contradictory forces that come into play when the level of land concentration is low. First, there is the general "rule" that the agricultural population with access to land probably has better access to food, than those who work on others' farms (and rely on the market). From this we should expect to find a lower level of food insecurity, the lower the level of land concentration, *especially* if a majority of the population lives and works in the agricultural sector. However, if there are (too) many people that rely on agriculture for their living in relation to the amount of agricultural land, there will be very little land per person. This means that the land/labor ratio—and, consequently, the labor productivity level—will be low. In this situation, peasants may not be able to produce enough food for themselves. In addition, they will not be able to produce the agricultural surplus needed by the industrial sector. Thus, when the land/labor ratio is low the level of food insecurity will be relatively high, both among the agricultural population and the population that depends on industry for a living. This produces the counter-intuitive results that low levels of land concentration combined with a large share of agricultural population, give higher levels of food insecurity than low levels of land concentration combined with a smaller share of the agricultural population.

Why, then, will food insecurity remain at a medium level when the level of land concentration is low, and not at a minimum level, even when the share of the agricultural population is small? The fact is that when a small share of the population depends on agriculture for a living, there is less food insecurity when the level of land concentration is high. This is because most people depend on industrial incomes for a living, and the rate of labor absorption in industry depends on an agricultural surplus—which is probably higher when land concentration levels are high. Thus, even if there is a high rate of food insecurity among the agricultural population when

the level of land concentration is high, the prevalence of food insecurity will be low as a percent of the total population.

This is why we find the highest levels of food insecurity in countries where high land concentration levels are combined with a large share of the agricultural population; the lowest levels of food insecurity are found in countries where a high level of land concentration is combined with a small share of the agricultural population; and medium levels of food insecurity are found where land concentration levels are low. Whether the level of food insecurity will be medium-high or medium-low when land concentration is low, depends primarily on how large is the share of agricultural population, and how much food is available in the country.

This brings us to the second important finding of the study: that food availability (per capita) influences the poor's access to food, and that this influence depends on the level of land concentration. There will always be a lower (predicted) level of food insecurity where the food availability level is high, but the effect that a given level of food availability has on (the predicted level of) food insecurity depends on the level of land concentration. In other words, the effect of land concentration on food insecurity depends on the food availability ratio. This effect is such that at high levels of land concentration there will be less food insecurity when the food availability level is high, while the level of land concentration does not matter much for food insecurity when the level of food availability is low. In short, there will always be a relatively high prevalence of food insecurity when the level of food availability is low.

This interaction between food availability and land concentration is relatively straightforward. It results from the assumption that a low level of food availability leads to high food prices, because the supply elasticity of food production is low.[1] When food prices are high, the poor will have access to less food. It is as this point that land concentration enters the picture. When the level of land concentration is high, less people have access to land and more people will be net-buyers of food (and depend on the market for their food security). In addition, the agricultural population will have lower incomes when landholdings are highly concentrated, and these people's level of food insecurity will deteriorate with any rise in food prices.

[1] I have not actively tested this assumption myself, but it rests on findings from previous work originally by Kalecki (1971).

There is a third dimension to this interaction between food availability and land concentration; one that the model does not capture.[2] In a context where the level of food availability is low and the level of land concentration is high, the incidence of food insecurity—as a percent of the *total* population—will be higher when a larger share of the population depends on agriculture for a living. Thus, it would appear as though there is a three-way effect on food insecurity, where land concentration, food availability, and the share of the agricultural population all interact.

To summarize, this study has shown that land concentration influences food insecurity in many different ways, albeit not always in the expected direction. In addition, this study has shown that food availability is much more important than most researchers within the entitlement approach tend to recognize. For example, Sen (1981: 8) argues that food availability is not directly involved in the poor's access to food. My thesis challenges this perception. By dismissing food availability, scholars from the entitlement approach ignore the fact that increased per capita food supply can considerably reduce food insecurity in many developing countries.

These are the results of a study that set out to address the potential for land reform as a policy option for reducing food insecurity in the developing world. In the following section I will discuss the most important lessons that these results teach us about the effectiveness of land reform. I will also compare the potential of land reform against the other main policy options that this study indicates have potential for reducing food insecurity in the developing world.

8.2 Implications for Policy

The main results of this study imply that there are three main groups of policies that developing countries can use to reduce food insecurity: policies to redistribute land (land reform); policies to increase food availability; and policies that reduce the share of the agricultural population (i.e., increase labor absorption into industry, or—in shorthand—industrialization).[3] The potential effect of any one of these policies depends on the characteristics of the specific country. Of course, the important

[2] This is because there were too few cases to test for a three-way interaction effect between land concentration, food availability, and the share of the agricultural population.

[3] These three groups stand out in importance because the effects of regime type and immunization are much weaker, and we cannot be certain why the regional dummies have an effect.

characteristics are: the level of land concentration, the share of the agricultural population, and the food availability ratio. In this section I will illustrate which policies have the largest potential to reduce food insecurity for countries that have different combinations of these characteristics. Before doing this, however, I will describe the three policy groups. As this discussion is meant to be illustrative, the sketch will be necessarily brief.

1) Land reform policies imply the redistribution of landholdings from large landholders to the landless or the land-poor. Since this study has investigated the relationship between the size distribution of landholdings and food insecurity, without being able to directly control for the prevalence and terms of tenancy, or landlessness, the results can (as mentioned in Section 4.2) only tell us about the potential of this (narrowly defined) type of land reform for reducing food insecurity.[4] If the regional dummies capture lower landlessness and tenancy rates, land reforms that give land to the landless (and not only to land-poor peasants), as well as tenancy reforms (giving the land to the tiller, or improving their contracts), could also be beneficial.

2) Policies that increase food availability are those that (for example) increase agricultural labor productivity, encourage farmers to produce food for the domestic market (instead of export crops), or increase the import of food. This study has found that a high level of land concentration can be beneficial for high levels of both labor productivity and food availability (see Sub-Section 7.2.1, and Figure 7.10). Thus, land reform may have a negative effect on food availability, while policies that raise agricultural labor productivity can help increase food availability. However, in order to simplify the discussion, I will assume that the level of food availability can (and will) be increased by means that are exogenous to the model. As I was only able to explain 36 percent of the variation in food availability by land concentration *and* agricultural labor productivity, it is justifiable to regard food availability as an exogenous variable. However, since I was not able to explain more than

[4] The implementation of land reforms is difficult because it (most often) challenges prevailing conceptions of property rights, and because it threatens the interests of a landowner class that typically enjoys enough power to disrupt the implementation process (as well as the legislation itself) (Thiesenhusen 1995). As my focus is on the effect of (implemented) land reform, I will not elaborate on these problems.

36 percent, it is difficult for me to say much more about the means to increase food availability.

3) Industrialization policy is what I call policies that decrease the share of the population that depends on agriculture for a living (by increasing labor absorption in the industrial sector). Like the two other policy options, this policy is not easy to implement. Of course, there is no simple recipe for how to increase labor absorption in industry. After all, industrialization is one of the main goals that developing countries have been striving towards (with varying success) over the past half-century. Industrial labor absorption is a function of total industrial production, and requires a balance between technology and labor intensity that maximizes the labor absorption rate at a level that does not compromise the growth potential. A growing agricultural surplus is generally needed to provide industries with food and raw materials as well as demand for their products. This requires that agricultural labor productivity must increase more than is necessary for self-consumption. As we have seen, a high level of land concentration facilitates this. However, the industrial sector also depends on effective demand (from the agricultural population) for their products. A (very) high level of land concentration is probably not beneficial for this effective demand, as a large share of agricultural population has a low income. However, in order to simplify the discussion of the effect of an industrialization policy, I will assume that the share of agricultural population can (and will) be reduced by means exogenous to the model.

Although it will not be easy to reach any of the goals these policy groups are meant to fulfill, it is important for countries to know how they might concentrate their efforts. Figure 8.1 will serve as an illustrative tool as we now turn to the discussion about which of these policy-groups has the largest potential to reduce food insecurity for countries with various combinations of land concentration, the share of the population that depends on agriculture for a living, and food availability. This figure is two-dimensional, but displays information on all four dimensions of land concentration, stunting, the share of the population that depends on agriculture for a living, and the food availability ratio (setting all other variables at their means).

As it is packed with so much information, I will take some time to explain the policy options available to countries in these different contexts.

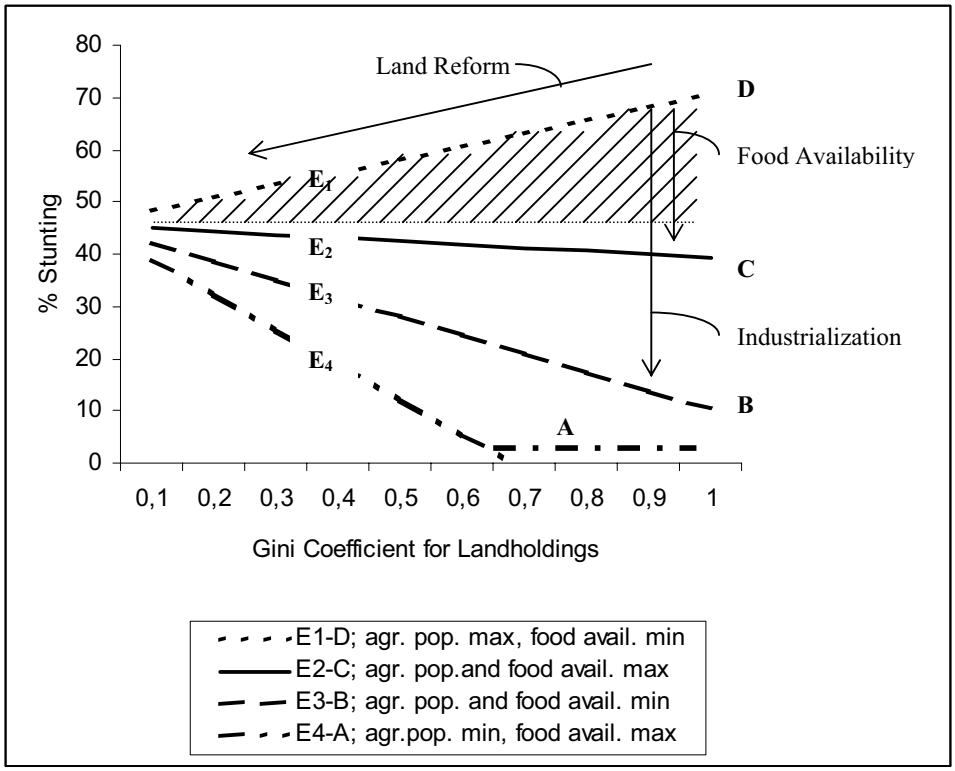
The figure is a conditional effect plot of land concentration's effect on the prevalence of stunting, as predicted by the model (of direct effects) represented by equation 7.1 (in Section 7.1) Thus, the lines show the predicted prevalence of stunting as land concentration changes for a number of combinations of the highest and lowest values (in the sample of this study) on the food availability ratio and the share of agricultural population (when all other variables are at their means).[5] These lines show that countries that have the maximum value for the share of agricultural population (92 percent), and a minimum value on the food availability ratio (72 percent), will have the highest predicted prevalence of food insecurity (these countries are found somewhere along the line **E_1-D**, according to their level of land concentration). Among countries with this combination of the share of agricultural population and food availability, the predicted prevalence of stunting will be higher the higher the level of land concentration. The line **E_4-A** shows that we will find the lowest prevalence of stunting in countries that have the minimum value on the share of the agricultural population (7 percent) combined with the maximum value of the food availability ratio (130 percent), and that (for this combination) the predicted prevalence of stunting is lower the higher the level of land concentration. If this combination of the share of agricultural population and food availability ratio is combined with a gini coefficient of approximately 0.6 or higher, we can see that the model predicts that there will be no food insecurity in the country.

In the real world, most (or all) countries will be situated somewhere between the line **E_1-D** and the line **E_4-A**, according to their combination of land concentration, share of agricultural population, food availability ratio, as well as the other variables in the model. (The *predicted* prevalence of stunting in the countries can be read from the Y-axis). Nevertheless, in order to illustrate which type of countries can benefit the most from the different policy-groups I will limit the discussion to eight possible cases of extreme values on the three contextual variables. These (extreme-value) combinations are depicted by the capital letters **A** to **E** in

[5] This conditional effect plot is comparable to the conditional effect plots in Section 7.1 (Figures 7.1 to 7.4) but it includes different combinations of the share of agricultural population and the food availability ratio.

Figure 8.1. The arrows in the figure show us the directional effects from the three different types of policies available to countries in Context **D** with respect to the contextual variables, as well as the predicted value of stunting. These arrows will be explained in further detail under the discussion of Context **D**, below.

Figure 8.1: Policy Options for Food Security



The purpose of this illustration is not to prescribe specific policies that will guarantee success for a given country, but to show the broad lines of policy options available to stereotypical countries as they strive for food security. However, before we move on to this discussion, a caveat is required. We must recall that there are sources of error in both the data and the model-specification (see Section 7.3). Furthermore, the model is based on a synopsis of the information in the sample. This means that there may not be any countries that fit exactly into the prescribed pattern. On the other hand, it is likely that some developing countries can have values on some of the variables that are outside the range of values in this sample. If these countries had been included in the estimation of the parameters in the model, they

would be (slightly) different, as would the model's policy implications.[6] Finally, the predicted level of stunting for any combinations of land concentration, share of agricultural population and food availability ratio are based on mean values of regime type, immunization, and the regional dummies. Thus, the effects in the real world will (of course) not be exactly as predicted by the model.

Table: 8.1 Contexts being Discussed

Context	Land Concentration	Share of Agricultural Population	Food Availability	Food Insecurity	Policy Options
A	High	Low	High	No	N/A
B	High	Low	Low	Medium	∉ Food availability
C	High	High	High	Medium	∉ Industrialization
D	High	High	Low	High	∉ Land reform ∉ Food availability ∉ Industrialization
E_1	Low	High	Low	Medium-high	∉ Food availability ∉ Industrialization
E_2	Low	High	High	Medium	∉ Industrialization
E_3	Low	Low	Low	Medium	∉ Food availability
E_4	Low	Low	High	Medium-low	∉ Increase land concentration

The model of food insecurity (equation 7.1) predicts that countries in context, **A** (and to the right of **A** along the X-axis) enjoy (full) food security, while the seven contexts ranging from **B** to **E_4** will suffer from food insecurity, albeit at different levels. For each of the seven extreme contexts with food insecurity, I will discuss the policy options that are most likely to reduce food insecurity. When I discuss the effect of the policies applicable in a given context, I discuss them one by one and keep all of the other variables constant (if not otherwise stated). In this way we can discuss how the countries in each context are affected if *only* that policy group is pursued.

[6] Since all parameters have a p-value of 0.055 or lower, the parameters should not change very much if more countries were added to the sample.

Table 8.2: Classification of Selected Countries by Context

Context	Countries
A	Trinidad and Tobago, Costa Rica, Paraguay, Brazil, Chile, Uruguay, Panama, (Jordan, Tunisia)
B	El Salvador, Peru
C	Madagascar, Uganda
D	(Kenya and Honduras, but medium value of stunting)
$\mathbf{E_1}$	Mauritania, (India), Niger, Rwanda, Lesotho, Cameroon
$\mathbf{E_2}$	Malawi, Thailand, Egypt
$\mathbf{E_3}$	Côte d'Ivoire, Ghana, Turkey, Philippines
$\mathbf{E_4}$	Morocco, Myanmar

Note: Not all countries can be placed in one of these contexts, as they have mean values on two or more of the contextual variables, or do not have the predicted level of stunting. Kenya and Honduras, for instance, have high levels of land concentration, a large share of agricultural population, and low levels of food availability, but lower than the predicted prevalence of stunting. Furthermore, Bangladesh, Nepal, India, and to a lesser degree Pakistan, have low levels of land concentration, a large share of agricultural population, and a low level of food availability, but higher levels of food insecurity than predicted. In addition, Jordan and Tunisia have lower levels of stunting than their relatively low level of land concentration (combined with a small share of agricultural population and high food availability ratio) predicts.

*Context **B***

Countries that find themselves in (the vicinity of) Context **B** already have a relatively low level of food insecurity in the context of a high level of land concentration, a share of agricultural population that is relatively small, and a low level of food availability. In order to reduce food insecurity further, these countries should concentrate on increasing food availability, as this group of policies can bring them all the way down to the line $\mathbf{E_4}$**-A** (which lies on top of the X-axis for gini coefficients higher than about 0.6), where the share of agricultural population is at its minimum, food availability is at its maximum, and there is no food insecurity.

In these countries we already find a very small share of the population that depends on agriculture for a living. For this reason, there is no (or little) scope for improvement on the industrialization front. If countries in this context undertake land reform, the level of food insecurity will actually rise. (We can see this by following the line **B-**$\mathbf{E_3}$, where the prevalence of stunting rises for countries in this context as we move from high to low levels of land concentration.) Even though these countries have few policies to choose from, they can possibly solve the problem of food insecurity by increasing their food availability ratio (by means exogenous to the model).

*Context **C***

A medium level of food insecurity combined with a high level of land concentration, a high food availability ratio and a large share of agricultural population are characteristic of a country that finds itself in Context **C**. The best policy option for countries in this context is industrialization. By pursuing this strategy (by means exogenous to the model) the countries can hope to move from Context **C** all the way to line $\mathbf{E_4}$-A (which covers the X-axis at this high level of land concentration), where food availability is at its maximum, the share of agricultural population is at its maximum, and level of food insecurity is zero.

In these countries, the food availability ratio is already high. Moreover, land reform will (probably) not help in this context, as there is no reduction in food insecurity as we move from high levels of land concentration to lower levels of land concentration (leftward along the line $\mathbf{C\text{-}E_2}$). Land reform will move the countries from **C** towards context $\mathbf{E_2}$, or to $\mathbf{E_4}$ if the industrialization strategy is pursued simultaneously. Thus, a combination of land reform and industrialization efforts will reduce food insecurity by much less than the industrialization strategy alone. I will return to the reasons for this below when I discuss Context $\mathbf{E_1}$ to $\mathbf{E_4}$, below.

*Context **D***

Countries in Context **D** will have the most severe problem: very high levels of food insecurity, a large share of the population that depends on agriculture for a living, and a low level of food availability, combined with a high level of land concentration. In this context, policy makers face three possible routes for improving food security: land reform, increasing the food availability rate, and industrialization. The arrows in Figure 8.1 show to what context, and corresponding predicted value of stunting, the different policy groups can take these countries.

If countries in Context **D** focus on policies to increase food availability, they can reduce food insecurity by moving the country from Context **D** to Context **C**. However, it is a relatively ineffective strategy (unless it is combined with industrialization), because the level of food insecurity is still relatively high in this new context (**C**).

These countries can also reduce food insecurity by means of policies to increase the level of industrialization (which is shorthand for reducing the share of

the population that depends on agriculture for a living). Obviously, like the food availability strategy, this is not a policy that may be directly accessible to policy-makers in a given country. However, if a country is able to "enjoy" industrialization, it can possibly decrease its level of food insecurity substantially (by moving from Context **D** to Context **B**). If it is also able to increase its food availability ratio substantially, it may possibly solve the problem of food insecurity completely.

Countries in Context **D** can also reduce their food insecurity by implementing land reform. We can see that if a country in this context implements land reform, it can decrease its level of food insecurity by moving from Context **D** to Context $\mathbf{E_1}$. While this is surely an improvement on the initial conditions, it is not a panacea: the model predicts that food insecurity will still affect about 50% of the population. In short, the land reform strategy alone does not improve conditions sufficiently.

Although Context **D** is the only one of the seven contexts *discussed* where land reform might have an effect on reducing food insecurity, there is scope for reductions in food insecurity by land reform for all countries that find themselves within the shaded area in Figure 8.1. The reason for this is that a movement towards lower land concentration gives a lower predicted prevalence of stunting. Nevertheless, the closer to the solid line (or to $\mathbf{E_1}$ or $\mathbf{E_2}$) that these countries are, the less is the scope for improvement by land reform. Since "real" countries will be placed in the figure according to the actual values for all the variables in equation 7.1, I cannot say exactly what values the countries in the shaded area will have on the share of agricultural population or food availability. However, we know from the discussion of Figure 7.1 (Section 7.1) that a country that has mean values for all other variables, must have a share of agricultural population (in total population) that is higher than 79 percent in order to be in the shaded area. We may recall from this discussion that 79 percent is the value where the model predicts that the effect of land concentration on food insecurity changes direction when all other variables are at their means. Countries with this particular combination of values for the variables can be found along the horizontal line at the bottom of the shaded area, according to their level of land concentration. We can see that there is no change in the predicted level of stunting as we move along this line. On the other hand, if the food availability ratio is at the maximum of the countries in this study, the line $\mathbf{E_2}$**-C** tells

us that land reform will not help, even if the share of the agricultural population is at the maximum in this study (when the other variables are at their means).

However, if countries in Context **D** (as well as anywhere else within the shaded area) implement extensive land reforms (that bring their gini coefficient down below 0.6), they may run into problems as a consequence of their attained low level of land concentration. The reasons for this will be explained under Context $\mathbf{E_1}$ to $\mathbf{E_4}$ below.

Contexts E_1 to E_4

A country in Context $\mathbf{E_1}$ has a low level of land concentration, a large share of agricultural population, and a low level of food availability. In addition, such a country suffers from a relatively high level of food insecurity (around 50 percent stunting). Land reform is not an option to these countries because the level of land concentration is already low. By increasing their food availability to the maximum level (in the sample of this study), such a country can move to $\mathbf{E_2}$, but its level of food insecurity will remain relatively high. By pursuing industrialization, such a country can move further down to $\mathbf{E_3}$ (improving food security as it goes), and if it pursues both industrialization and food availability policies simultaneously, it can arrive at $\mathbf{E_4}$. However, this combined strategy still leaves the country in question with considerable food insecurity. Thus, at low levels of land concentration, food availability and industrialization strategies can only reduce food insecurity to about 25 percent. The reason that considerable food insecurity will remain in this context is that most people live (and try to find work) in the industrial sector, while labor productivity in agriculture is relatively low (because of a relatively low land/labor ratio) and self-consumption is relatively high (because of a relatively low level of land concentration).[7] If my analysis is correct, the countries in Context $\mathbf{E_4}$ must move rightward towards **A** along the line $\mathbf{E_4}$**-A**, and *increase* their level of land concentration (the size distribution of landholdings), in order to obtain lower levels of food insecurity. In the following section we will see why this may be easier said than done.

[7] I have not been able to test whether self-consumption is higher when land concentration is low in the countries under study. The only empirical support for this argument is the data on changes in the agricultural surplus after the Chinese land reform (collectivization) in the 1950s (see Table 5.3).

8.3 A Low Land Concentration Trap?

Despite the hopes and ambitions of many developing country politicians and activists, the results of this thesis indicate that there are very few countries where land reform could help to reduce food insecurity. Indeed, for most countries, land reform will only worsen the situation. If we keep regime type, immunization, and the regional dummies out of the discussion by assuming that these always have mean values, it seems like the only countries that could possibly benefit from land reform are those with a large share of agricultural population and a low to medium level of food availability (and, of course, a high level of land concentration).[8] However, if the land concentration level falls below medium (a gini coefficient of about 0.6) the results of this study indicate that full food security is best secured by allowing an increased concentration of landholdings.

The crucial question then becomes: is it possible for countries with low levels of land concentration to achieve full food security? The "natural" way to achieve fewer and larger landholdings (increase land concentration) is by way of people leaving the agricultural sector for work in industry. For this to happen, labor absorption in industry has to increase. This, in turn, means that the industrial sector has to grow. But the industrial sector depends on an agricultural surplus to provide food and raw materials, as well as capital, foreign currency, and demand for industrial products. For the agricultural sector to provide these necessary inputs for industrial development, agricultural workers must produce enough for themselves, their dependants, and the additional surplus.

However, one of the findings in this study is that when land concentration is low, so too is the land/labor ratio. As an extension, I find that when the land/labor ratio is low, agricultural labor productivity is also low. Moreover, when low labor productivity levels are combined with low levels of land concentration, a large share of the agricultural output will (probably) be consumed in the agricultural sector. As a result, the agricultural surplus available for industrialization will be small. Furthermore, as the population grows (as it still does in most parts of the developing world), and the industrial labor absorption rate remains small, parents will have to

[8] In order not to complicate matters too much, I will assume that all other variables than land concentration, the share of the population that depends on agriculture for a living, and the food availability ratio are (always) at their means, throughout the discussion of the potential for land reform.

sub-divide their holdings to provide land for their children. Consequently, the land/labor ratio and the (agricultural) labor productivity level decrease further. As if this were not bad enough, the struggle to survive from very small holdings may lead to an over-intensive use of the land and deteriorating land productivity (with a corresponding decline in labor productivity).

Low levels of land concentration are often seen as beneficial for the purchasing power of the agricultural population, and thereby beneficial for the effective demand for consumer goods that (infant) industries need in order to grow (and absorb more labor) (e.g., Prosterman et al. (1990) and Barraclough (1973 and 1991)). However, when the level of land concentration is very low, the agricultural population will not be able to afford many industrial products. This is because a low land/labor ratio, and, consequently, a low level of agricultural labor productivity, means that the peasantry cannot produce a surplus that can be "traded" for consumer products.

Thus, it seems as though countries with low levels of land concentration cannot take the "natural" path for increasing their level of land concentration. Is it, then, possible to implement some kind of reverse land reform, where landholdings become larger, in order to increase the land/labor ratio and the agricultural labor productivity? According to Moore (1966), the enclosures of the commons in 17th century England contributed to industrialization because it forced peasants (that could no longer make a living from their small holdings) to seek work in towns, thereby contributing to fewer, larger holdings that could produce an agricultural surplus. On the other hand, the enclosure movement was devastating for the peasants who were compelled to leave their land. Policy interventions that (so openly) take from the poor and give to the rich are simply not (ethically or politically) acceptable today. Thus, reverse land reform, with the aim of increasing the land/labor ratio, is not a viable option.

Perhaps Malthus was right after all? Perhaps these countries are facing the problem of too many people on too little land? Can it be that population control or starvation are the only available options? Population control could surely check the further decrease in the land/labor ratio; if the absolute number of people decreases, the land/labor ratio (and thus the labor productivity level) would increase. The problem with this strategy is that children are often the only (age and illness)

insurance available for poor people in developing countries. Thus, it would probably take a very long time to reduce population growth by means of "voluntary" family planning (in a context of economic stagnation or decline). Just as reverse land reform is ethically or politically anathema, so too is forced family planning (cf., China). Since countries with high levels of land concentration can possibly escape from food insecurity almost regardless of their population level, it is the low level of land concentration, not population growth, which traps these countries.

Another possibility could be to improve land productivity such that labor productivity rises, despite the low land/labor ratio. But is this possible—in the context of a very low land/labor ratio? We can recall from Chapter 2 that the "technology optimists" within the food availability approach argue that technological developments can solve the problem of low labor productivity in agriculture. Furthermore, despite the finding of this thesis that the land/labor ratio is very important for labor productivity, Hayami and Ruttan (1985) suggest that there is scope for improvement in agricultural labor productivity, even where the land/labor ratio is very low. They argue that this is made possible through investments in education, technology and infrastructure. However, since peasants are poor (because of the low level of agricultural labor productivity) they do not have the means to acquire costly inputs. While agricultural extension programs could be implemented to fill this need, a context characterized by low levels of agricultural productivity (and a low level of industrialization) makes it unlikely that these countries can afford to implement aggressive agricultural extension programs.

On the other hand, it was exactly these factors (mentioned by Hayami and Ruttan) that were at the heart of the Green Revolution. This revolution took place in the developing world in the 1960s, 1970s and 1980s, and boosted agricultural labor productivity in the developing world to previously unseen levels—by way of increased land productivity. The most important components of the Green Revolution were the increased use of chemical fertilizers, pesticides and irrigation, in combination with the adoption of new, high yielding varieties of crops that could utilize these inputs more effectively than the old varieties. Equally important was the economic assistance from the industrialized world that helped poor farmers finance

the new inputs, and developing country governments to invest in education and infrastructure.[9]

In South Korea, for instance, where the land/labor ratio was extremely low (only 0.4 hectares per economically active in agriculture), labor productivity increased by 103 percent (from 2,609 to 5,297 US$) between 1965 and 1985. This was mainly because land productivity increased by 96 percent (from 6,547 to 12,845 US$) in the same period, (most probably) as a result of the Green Revolution. (The land/labor ratio stayed approximately the same).[10] As mentioned in Chapter 1, South Korea had at this time already implemented a land reform. As a result of this land reform, the gini coefficient for landholdings was only about 0.35 in the period where land productivity increased by 96 percent. This shows that it is possible to increase land productivity even when land concentration and the land/labor ratio are low, if the conditions are right.

In this light, it is important to take note of the fact that many of the countries that find themselves in the context of low land concentration (and a low land/labor ratio) and medium to high levels of food insecurity are found in Sub-Saharan Africa. This is important because the Green Revolution to a large extent bypassed this part of the developing world. Consequently, this region has a potential to increase land productivity with existing (Green Revolution) technologies, if they are given the same economic assistance that many countries in other developing regions received during the Green Revolution.[11] It is also important to realize that both land and labor productivity in South Korean agriculture is much higher than the average for South

[9] Economic support for the research that lead to these new technologies, as well as its spread in the developing world, came primarily from US AID, The Ford Foundation, and the Rockefeller Foundation, while several other western countries gave some economic support. However, many critics of the Green Revolution argue that the extension programs did not reach those that needed them the most, and that it was the medium sized farms that benefited the most. As a consequence the poorest farmers became even more marginalized, and were in turn often forced to sell their land to those that had benefited from the Green Revolution. Additionally, it is argued that the chemical inputs and extensive irrigation that was a central part of the revolution has had devastating environmental consequences. In this way, it is argued, the Green Revolution made things worse for poor farmers (e.g., Shiva 1993).

[10] Land and labor productivity is measured in constant 1995 US$, and the source of these data is World Bank (2003). For the land/labor ratio, the source is FAO (2002b), and for the gini coefficient it is IFAD (2001: 118).

[11] The most important staple food in Sub-Saharan Africa is maize, and high yielding varieties of this crop (that can utilize fertilizers and irrigation effectively) have already been developed. In addition, it is possible that the (controversial) developments within biotechnology can help these countries improve their land productivity even further.

Asia, where most of the other countries with low land concentration, low land/labor ratio and relatively high food insecurity are found.[12] Consequently, it seems as though it may also be possible to increase further land productivity in these countries, given the right conditions.

Thus, there is some hope that the countries in "the low land concentration trap" may escape the Malthusian mechanism. However, it would appear that countries with low levels of land concentration have greater difficulty in alleviating food insecurity without some kind of outside help, as they seem trapped in stagnation caused by their low land/labor ratio.[13] Nevertheless, this does not change the main conclusion about the potential that land reform has to reduce food insecurity in the developing world. For most countries, land reform will not bring about the desired reduction in food insecurity. While there may be other motivations for land reform (e.g., redistributive justice), policymakers should be aware that increased land redistribution might actually increase food insecurity in the country.

In light of the popularity of land reform as a policy for reducing poverty, it is remarkable that only a few of the countries in this study find themselves in a context where they could benefit from limited land reform (i.e., a high enough level of land concentration and share of agricultural population, combined with a low enough food availability ratio). For the majority of the countries in this study, land reform seems to be an inappropriate strategy. More worrisome yet is the fact that a whole range of countries in Sub-Saharan Africa and South East Asia (about 60 percent of the countries in this sample) have relatively low levels of land concentration (below the approximate border line of 0.6) combined with medium levels of food insecurity. The lower a country's gini coefficient, the higher the level of food insecurity with which these countries may be trapped, if they do not receive help from the outside to increase land and labor productivity levels in agriculture.

However, two modifications to the conclusion about the limited potential for land reform should be made. First, countries in the shaded area of Figure 8.1 will

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[12] Land productivity in South Asia was only 442 US$ per hectare in 1985, and 700 US$ per hectare in the year 2000, while agricultural labor productivity was 311 and 730 US$ per worker in the respective years.

[13] Thus, it is problematic that this kind of support largely withered in recent decades, as the focus has been on reducing nearly all kinds of governmental spending in developing countries, instead of helping them to finance (agricultural) extension and infrastructure programs.

only find themselves in the trap if their gini coefficient for landholdings (after land reform is implemented) becomes lower than approximately 0.6. We see from Figure 8.1 that countries in the shaded area below this value on the gini coefficient will not be able to reach the X-axis (of no food insecurity), no matter what combination of the share of agricultural population and food availability they might have. However, if more limited land reforms are implemented, and the land concentration stays above a gini coefficient of 0.6, the countries with a high share of agricultural population and low to medium levels of food availability can still resolve the problem of food insecurity. If these countries subsequently (or simultaneously) pursue policies to increase industrialization and food availability, they can move to very low levels of (or no) food insecurity. However, land reform alone will not allow them to achieve this goal.

The second modification relates to the vast areas of idle land that can often be found in countries with high levels of land concentration (especially in some Latin American countries). In these countries, land and labor productivity will probably increase after partial land reform, as more land will be brought into productive use. As the potential to increase agricultural labor productivity by utilizing previously idle land is not captured by the variables included in this study, land reform may reduce food insecurity in more of these countries than the model in Figure 8.1 predicts.

8.4 Further Research

For most countries, land reform will not bring about the desired reduction in food insecurity. While there may be other motivations for land reform (e.g., redistributive justice), policymakers should be aware that land reform might actually decrease food security in the country. The more equally land is distributed (below a gini coefficient of about 0.6), the higher the level of food insecurity the country may be trapped with—even if that country increases food availability and industrialization to the highest levels.

Thus, it is worrisome that a whole range of countries in Sub-Saharan Africa and South East Asia (about 60 percent of the countries in this sample) have low levels of land concentration (below the approximate border line of 0.6) combined with medium levels of food insecurity. Future research should be aimed at

understanding how these countries can get out of the low land concentration trap and (more specifically) whether another Green Revolution could provide solutions.

In addition, I was unable to test all of the theoretical links between land concentration, food availability and food insecurity in the conceptual scheme (described in Chapter 5). This test could not be implemented because of the lack of data on enough cases to perform a cross-country, multivariate test. However, it is likely that indicators for all (or most) of these relations can be found for one or a few countries. Thus, case studies could be used to investigate more closely the supposed causal relationships between several important variables: land concentration, the land/labor ratio, agricultural land and labor productivity, the agricultural surplus, industrial labor absorption, and food insecurity.

More information could also be gathered on food security among the agricultural and the non-agricultural populations, to see whether a high level of land concentration leads to a high level of food insecurity among the agricultural population, and a low level of food insecurity among the non-agricultural population, as the results of this analysis indicate. Such data could also propel a comparative case study on the effect of land reforms on food insecurity in these two populations. It may also be possible to study the short- and long-term changes in food insecurity, in both the agricultural and the non-agricultural population, in countries that have pursued different routes to food security (the food availability route, the land reform route, or the industrial labor absorption route).

Finally, another possible path to pursue concerns the finding that a high food availability ratio contributes to a lower level of food insecurity. In the World Trade Organization, efforts are underway to liberalize agricultural trade from the developing to the developed world. In this context it is hoped that increased access to world markets will increase agricultural exports and encourage growth in the agricultural sector of developing countries, giving them access to much-needed foreign exchange. However, the increased export of agricultural products will most likely reduce the level of food availability in developing countries. There are three reasons for this pessimistic conclusion. First, more farmers will probably turn to export crops, instead of food crops for the domestic market. Second, farmers with large holdings are those with the greatest incentive to take advantage of the new export possibilities. Third, it is doubtful, perhaps dubious, to expect that the export

revenues generated by these new agricultural exporters will be spent on cheaper food imports that could benefit the poor. Thus, increased agricultural exports will probably lead to increased food insecurity. In this regard there is a need to find out whether developing country agricultural exports are dominated by farmers with large holdings (including multinational agribusiness companies) and whether agricultural exports from developing countries lead to a net reduction in food availability (or if the effect on food availability is neutralized by food imports).

Millions of people in the developing world are still tormented by food insecurity. The suffering of each and every one of them shouts out for a solution. To date, progress is all too slow. Even if the relatively optimistic goal of the "World Food Summit" (to (only) *halve* the prevalence of food insecurity in the developing countries by 2015) is to have any chance of realization, we need the results of more research to understand which policies work best, in different contexts. Unfortunately, research alone cannot solve this enormous problem. More than anything else, solutions require will and determination. These factors are not the direct result of research itself, but research can help the willing and the determined to alleviate food insecurity more effectively.

APPENDIXES

Appendix A: Data

Country	Stunting %	Gini coef. landholdings	Agricultural population %	Food Availability Ratio	Regime type	Immuni-zation %	Civil War
Cameroon	30.8	.42	63	90	-8	36.0	0
Cote d'Ivoire	20.8	.36	58	100	-8	18.5	0
Ethiopia	64.2	.32	76	73	-8	9.0	1
Ghana	26.1	.44	51	78	-7	21.5	0
Kenya	33.3	.77	78	95	-6	66.5	0
Lesotho	37.0	.47	81	101	-7	77.5	0
Madagascar	33.8	.80	77	108	-6	14.5	0
Malawi	52.8	.36	77	104	-9	52.0	0
Mauritania	34.0	.36	65	90	-7	34.0	1
Niger	37.7	.35	82	97	-7	15.5	0
Rwanda	42.7	.39	92	83	-7	51.0	0
Sierra Leone	35.2	.44	64	78	-7	--	0
Uganda	42.2	.62	82	107	-7	15.5	1
Brazil	15.4	.86	26	111	2	71.5	0
Chile	9.6	.64	14	104	-6	91.0	0
Colombia	24.9	.71	29	112	8	56.0	1
Costa Rica	7.6	.67	26	125	10	84.0	0
Dominican Rep.	20.6	.70	38	112	6	46.5	0
El Salvador	29.9	.57	39	94	6	74.0	1
Guatemala	57.0	.72	52	107	-1	23.5	1
Honduras	37.2	.73	58	98	6	55.5	0
Panama	15.5	.88	26	105	-1	78.5	0
Paraguay	13.5	.91	48	124	-3	52.5	0
Peru	37.8	.61	38	90	7	50.5	1
Trinidad & Tobago	4.8	.61	8	120	9	54.5	0
Uruguay	15.9	.84	14	105	1	61.0	0
Egypt	30.7	.35	62	130	-5	79.0	0
Jordan	15.8	.57	7	121	-7	79.0	0
Morocco	22.6	.47	38	113	-8	48.0	1
Tunisia	17.5	.58	26	117	-7	67.5	0
Turkey	20.5	.40	46	85	6	58.0	1
Yemen	44.1	.64	--	94	-6	12.5	0
Bangladesh	67.5	.50	70	78	-6	1.5	1
Bhutan	56.1	.57	91	107	-8	42.5	0
India	51.8	.43	63	96	8	9.5	1
Myanmar	49.7	.44	48	116	-7	12.0	1
Nepal	62.0	.33	92	91	3	33.0	0
Pakistan	57.9	.37	54	94	5	34.0	0
Philippines	42.8	.53	47	100	-9	54.0	1
Sri Lanka	27.2	.62	52	112	6	45.0	1
Thailand	21.5	.36	62	108	6	44.0	0
Mean value	33.4	.55	53	102	-1.9	45.8	.34
Minimum	4.8	.32	7	73	-9	1.5	0
Maximum	67.5	.91	92	130	10	91	1
Standard dev.	16.5	.17	23.7	13.9	6.39	24.3	.48
Number of cases	41	41	40	41	41	40	41

Continued

Country	Land Productivity	Land /Labor ratio	Agric. Labor Productivity	GDP per capita	Water and Sanitation	Sub-Saharan Africa dummy	Near East & North Africa dummy
Cameroon	305	3.10	936	730	69.5	1	0
Cote d'Ivoire	103	7.06	783	820	56.5	1	0
Ethiopia	--	--	--	84	17.5	1	0
Ghana	151	3.38	552	345	58.0	1	0
Kenya	75	7.94	256	337	62.0	1	0
Lesotho	36	9.00	504	461	--	1	0
Madagascar	29	6.63	191	282	40.0	1	0
Malawi	89	1.10	94	147	61.0	1	0
Mauritania	4	77.11	328	458	33.5	1	0
Niger	43	4.39	183	242	34.0	1	0
Rwanda	433	1.31	331	309	--	1	0
Sierra Leone	145	2.88	508	273	--	1	0
Uganda	210	1.29	273	237	64.0	1	0
Brazil	189	27.07	2580	3915	77.0	0	0
Chile	139	18.96	3677	2678	93.5	0	0
Colombia	161	12.15	3212	2049	84.5	0	0
Costa Rica	331	9.67	3177	2637	--	0	0
Dominican R	392	5.13	1577	1345	69.0	0	0
El Salvador	869	1.96	1686	1346	--	0	0
Guatemala	694	2.68	1892	1312	77.5	0	0
Honduras	158	4.76	743	682	--	0	0
Panama	260	9.07	2360	2393	--	0	0
Paraguay	80	36.03	2910	1822	76.0	0	0
Peru	105	12.89	1300	2305	68.0	0	0
Trinidad & Tobago	622	2.63	1850	5146	--	0	0
Uruguay	89	77.16	6537	4832	--	0	0
Egypt	2896	.30	853	857	90.5	0	1
Jordan	153	10.50	1317	1520	97.5	0	1
Morocco	183	7.37	1333	1186	68.5	0	1
Tunisia	235	9.97	2290	1722	78.0	0	1
Turkey	567	3.13	1780	--	83.5	0	1
Yemen	--	9.10	--	277	52.5	0	1
Bangladesh	685	.30	246	246	64.0	0	0
Bhutan	685	.55	126	364	--	0	0
India	376	.83	304	313	49.5	0	0
Myanmar	--	.73	--	--	54.5	0	0
Nepal	303	.97	177	206	43.5	0	0
Pakistan	366	2.45	455	430	59.0	0	0
Philippines	1290	1.06	1232	1183	80.5	0	0
Sri Lanka	977	.74	731	461	74.0	0	0
Thailand	652	1.89	713	2002	78.5	0	0
Mean value	396.8	9.9	1315.7	1229.6	65	.32	.15
Minimum	4	.3	94	84	17.5	0	0
Maximum	2896	77.1	6537	5146	97.5	1	1
Standard deviation	511.17	17.3	1320.4	1262.5	18.601	.47	.36
Number of cases	38	40	38	39	31	41	41

-- means missing

Appendix B: Regression Results

This appendix shows the step-wise removal of variables in Section 5.1 from the first model of direct effects on food insecurity (in Table B.1) to the final model (of the direct effect on food insecurity) in Table B.9. The variables were removed step-wise from the model according to the strength of the standardized coefficient, the p-value, and the changes in R^2. I have used +/- 0.200 as an approximate lower-limit for the standardized coefficient, and 0.05 as the significance level. There are twelve variables in the first model and only 27 cases (because of missing variables), which means that the model has very low degrees of freedom. When there are low degrees of freedom, it is difficult to obtain significant parameters. Thus, in the first rounds of re-specification, I mainly study the standardized regression coefficients. As the number of variables decrease, and the degrees of freedom increase, I will also consider the p-value of the coefficients, and changes in R^2.

After each step of variable-removal, the previously removed variables were included again, one by one. The only variable that had an acceptable effect when reintroduced was Immunization (it became relatively strong and significant again after the removal of Agricultural Labor Productivity). This is why Immunization appears in the final model of direct effects in Table B.9, despite being removed in the seventh re-specification round.

The results of the re-specification rounds are shown in Tables B.1 to B.9. I have only showed the reintroduction step for immunization, as the other variables did not have an effect when reintroduced.

Continued

Table B.1: First Model of Direct Effects on Food Insecurity

	Unstandardized Coefficients (B)	Standardized Coefficients (Beta)	P-value
(Constant)	69.304		.458
Gini coefficient for landholdings	- 21.466	- .234	.915
Interaction gini landholdings and agricultural population	.776	.673	.129
Food availability ratio	- .176	- .141	.863
Interaction gini landholdings and food availability ratio	- .310	- .429	.858
Agricultural labor productivity	-1.919E-03	- .122	.704
Sub-Saharan Africa	- 22.596	- .678	.022
Near East and North Africa	- 8.133	- .184	.495
GDP per capita	- 1.217E-03	- .071	.835
Civil war	2.855	.088	.594
Regime type	- .357	- .137	.569
Immunization	- 5.444E-02	- .080	.748
Water and sanitation	4.782E-02	.050	.863

Note: $R^2 = 0.772$, N = 27
Operationalization and Sources: See Section 6.2

Table B.2: First Respesification

Model	Unstandardized Coefficients (B)	Standardized Coefficients (Beta)	P-value
Constant	68.695		.227
Gini coefficient for landholdings	-21.253	-.221	.842
Interaction gini for landholdings and agricultural population	.694	.594	.017
Food availability ratio	-.142	-.112	.801
Interaction gini for landholdings and food availability ratio	-.283	-.374	.777
Labor productivity	-1.779E-03	-.112	.612
Sun-Saharan Africa	-20.956	-.604	.000
Near East and North Africa	-8.320	-.164	.307
GDP per capita	-1.197E-03	-.084	.670
Civil war	3.162	.091	.407
Regime type	-.400	-.160	.269
Immunization	-5.822E-02	-.084	.558

Note: $R^2 = 0.821$, N = 35
Operationalization and Sources: See Section 6.2

Table B.3: Second Respesification

Model	Unstandardized Coefficients (B)	Standardized Coefficients (Beta)	P-value
Constant	48.412		.346
Gini coefficient for landholdings	3.410	.036	.972
Interaction gini for landholdings and agricultural population	.678	.580	.002
Food availability ratio	6.820E-02	.055	.892
Interaction gini for landholdings and food availability ratio	-.520	-.695	.586
Labor productivity	-2.962E-03	-.185	.380
Sun-Saharan Africa	-22.256	-.641	.000
Near East and North Africa	-13.525	-.292	.021
Civil war	3.084	.091	.410
Regime type	-.625	-.253	.050
Immunization	-6.922E-02	-.099	.482

Note: $R^2 = 0.811$, N = 36
Operationalization and Sources: See Section 6.2

Table B.4: Third Respesification

Model	Unstandardized Coefficients (B)	Standardized Coefficients (Beta)	P-value
Constant	50.068		.005
Interaction gini for landholdings and agricultural population	.678	.580	.001
Food availability ratio	5.200E-02	.042	.772
Interaction gini for landholdings and food availability ratio	-.488	-.652	.005
Labor productivity	-3.006E-03	-.188	.327
Sun-Saharan Africa	-22.279	-.641	.000
Near East and North Africa	-13.530	-.292	.019
Civil war	3.119	.092	.377
Regime type	-.626	-.253	.044
Immunization	-6.767E-02	-.097	.431

Note: $R^2 = 0.811$, N = 36
Operationalization and Sources: See Section 6.2

Table B.5: Fourth Respesification

Model	Unstandardized Coefficients (B)	Standardized Coefficients (Beta)	P-value
Constant	54.486		.000
Interaction gini for landholdings and agricultural population	.658	.563	.001
Interaction gini for landholdings and food availability ratio	-.458	-.613	.001
Labor productivity	-3.248E-03	-.203	.263
Sun-Saharan Africa	-22.317	-.642	.000
Near East and North Africa	-12.988	-.281	.015
Civil war	2.940	.087	.389
Regime type	-.627	-.254	.040
Immunization	-6.635E-02	-.095	.431

Note: $R^2 = 0.810$, N = 36
Operationalization and Sources: See Section 6.2

Table B.6: Fifth Respesification

Model	Unstandardized Coefficients (B)	Standardized Coefficients (Beta)	P-value
Constant	56.751		.000
Interaction gini for landholdings and agricultural population	.699	.598	.000
Interaction gini for landholdings and food availability ratio	-.489	-.654	.000
Labor productivity	-2.523E-03	-.158	.360
Sun-Saharan Africa	-23.129	-.666	.000
Near East and North Africa	-12.225	-.264	.018
Regime type	-.593	-.240	.048
Immunization	-9.298E-02	-.134	.236

Note: $R^2 = 0.805$, N = 36
Operationalization and Sources: See Section 6.2

Table B.7: Sixth Respesification

Model	Unstandardized Coefficients (B)	Standardized Coefficients (Beta)	P-value
Constant	54.042		.000
Interaction gini for landholdings and agricultural population	.722	.618	.000
Interaction gini for landholdings and food availability ratio	-.507	-.688	.000
Labor productivity	-3.452E-03	-.217	.190
Sun-Saharan Africa	-23.493	-.696	.000
Near East and North Africa	-13.677	-.296	.007
Regime type	-.588	-.240	.047

Note: $R^2 = 0.795$, N = 37
Operationalization and Sources: See Section 6.2

Table B.8: Seventh Respesification

Model	Unstandardized Coefficients (B)	Standardized Coefficients (Beta)	P-value
Constant	55.914		.000
Interaction gini for landholdings and agricultural population	.801	.647	.000
Interaction gini for landholdings and food availability ratio	-.636	-.847	.000
Sun-Saharan Africa	-22.677	-.647	.000
Near East and North Africa	-15.486	-.312	.003
Regime type	-.694	-.268	.024

Note: $R^2 = 0.760$, N = 40
Operationalization and Sources: See Section 6.2

Table B.9: Eighth Respesification = Final Model of Direct Effects on Food Insecurity

Model	Unstandardized Coefficients (B)	Standardized Coefficients (Beta)	P-value
Constant	60.046		.000
Interaction gini for landholdings and agricultural population	.711	.574	.000
Interaction gini for landholdings and food availability ratio	- .552	- .725	.000
Sun-Saharan Africa	- 21.549	- .598	.000
Near East and North Africa	- 12.419	- .250	.018
Regime type	- .648	- .248	.030
Immunization	- .153	- .218	.044

Note: $R^2 = 0.790$, N= 39
Operationalization and Sources: See Section 6.2

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