FEAST OR FAMINE: TRADE DISTORTIONS AND FOOD INSECURITY IN DEVELOPING STATES

by

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(Under the Direction of Maurits van der Veen)

ABSTRACT

Food insecurity is defined as a situation that exists when people lack physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO 2000). With eighty percent of the world currently residing in the less developed states and more than 95 percent of the world population increase expected in these states in the next decade, further attention to problem of food insecurity must focus on the developing world. What causes food insecurity in developing states? Current literature offers several explanations for food insecurity including: low production levels, natural disasters, and policies that discourage agricultural trade. This thesis: builds upon the political economic literature, argues that agricultural trade policies may lead to food insecurity, and uses data from the World Bank and FAO from 1990 to 2004 to test the current explanations for food insecurity. The research findings suggest that agricultural trade policies must be taken into account when determining whether food insecurity is likely to increase in a given state.

INDEX WORDS: food insecurity, developing states, trade distortions

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GROWING CONCERNS: TRADE DISTORTIONS AND FOOD INSECURITY IN DEVELOPING STATES

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DEDICATION

To my dear husband, family, and friends.

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TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER 1

AN INTRODUCTION

The purpose of this thesis is to examine the political causes of food insecurity within developing states. Food insecurity can be observed at the individual, state, and international levels. Individual level food insecurity may be defined as the condition in which a person's system suffers from malnutrition and cannot maintain its normal functions (Hopkins 1986). State level food insecurity is defined as a situation that exists when a part of a state's population lacks physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO 2000). International food insecurity may best be characterized by shortages in the global food supply correlated with an increase in prices. In this situation, food supply is directed at those able to afford the rising costs.

This thesis will focus on the state level of analysis. As Raymond Hopkins suggests in his work, "Food Security, Policy Responsibility and the Evolution of State Responsibility," the very "political legitimacy and security of the state" are tied to avoiding food insecurity (14). Individual households that are food insecure put pressure on the state to respond to alleviate their suffering. Thus the importance of the state in responding to food insecurity is that it has the normative responsibility to alleviate suffering. Further, there is no international authority that can authorize the reallocation of food in times of dietary insecurity. Thus states are essential actors in responding to food insecurity.

The purpose of this thesis is to systematically examine causes of food insecurity in developing states. Though food insecurity does exist in parts of the population living in developed states, eighty percent of the world's food insecure is living in developing states. Moreover, ninety-five percent of the overall population increase in the next decade is estimated to occur in developing states (Pinstrup-Andersen 2001). According to projections of the

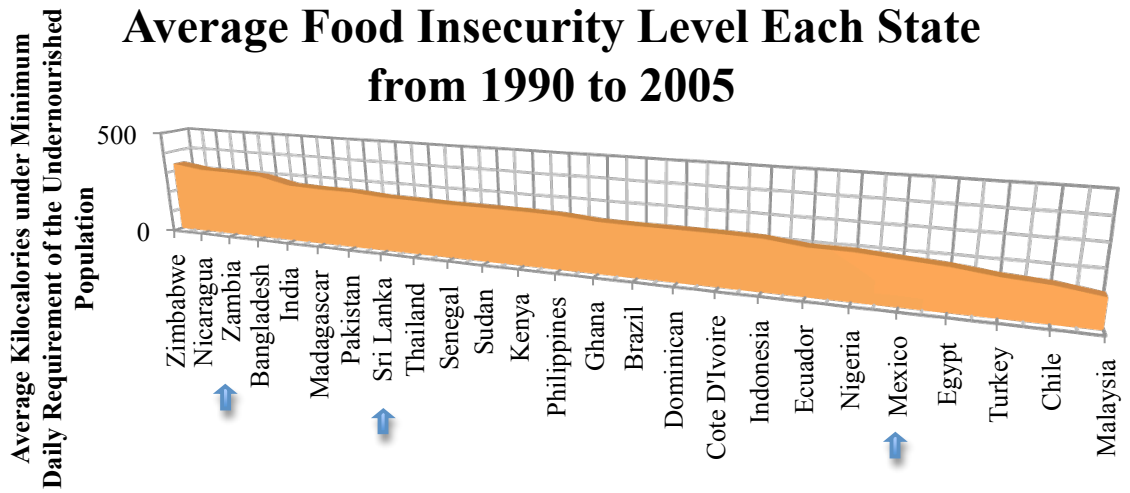
International Food Policy Research Institute, global cereal production is projected to increase by 56% and livestock production by 90% between 1997 and 2050. With population increasing most rapidly in developing states, the demand for cereal will grow by 93 percent and the demand for meat by 85 percent within these states (Rosegrant et. al. 2007).

In Lester Brown's book, *Who Will Feed China?: Wake Up Call for a Small Planet*, he warns the "collision of expanding human demand with some of the earth's natural limits…will have an economic impact that affects the entire world" (132). Brown notes that China's population boom has led to an increase in food demand and that the Chinese government has responded to this demand by making strategic shifts away from self-sufficiency in staples such as grain. Instead, the Chinese government has begun to rely on importing grain. Brown warns that this policy choice may result in a global grain scarcity as production has fallen behind population growth, dropping nearly one percent a year. Thus policies implemented in developing states will have a major impact on future issues of food insecurity.

Most often, explanations for food insecurity have come from outside the field of political science. Attention to food insecurity first appeared in the area of nutrition studies. Scholars in this field argue that failure in states to increase production levels has resulted in an increase in food insecurity in developing states (Borlaug 2000). In the 1980s and 1990s, geographers began to focus on how natural disasters affect crop failures and led to an increase in vulnerability and food insecurity. Economists studying food insecurity argue that high levels of protectionism may explain increases in levels of food insecurity. The literature in political economy has offered insights into the role governments play in guaranteeing food access and affordability for their citizenry. Previous literature has focused on individual case studies. The aim of this thesis is to examine the possible causes of food insecurity presented in these studies in a more systematic manner.

Though the food insecurity measurement chosen in this study will be discussed in greater detail in the research design, it attempts to capture the intensity of food deprivation for the undernourished population in a given state. Thus it is calculated by subtracting the average number of kilocalories (or commonly understood to be food calories) obtained by the undernourished population from the average daily requirement of kilocalories needed for a "healthy, active life" (FAO 2009). It is understood that both developing and developed states have a sector of the population that is undernourished. The food insecurity level thus serves to capture the intensity of food deprivation for that sector of the population in each state. Developed states' average food insecurity level is 134 whereas the average food insecurity level for developing states is 223 (FAO 2009, World Bank 2009). Figure 1 illustrates the food insecurity levels for the states included in this study (FAO 2009). Arrows highlight states mentioned in the puzzle.

Figure 1



FAO (2009)

By systematically examining food insecurity levels for different states systematically, puzzles become more apparent that the current literature has not yet addressed (see Table 1 below).

Table 1: Expected versus Actual Food Insecurity Levels for Mexico, Sri Lanka and Zambia

State	Population Increase from 1990 to 2004	Average Change in Production Level from 1990 to 2004	Number of Natural Disasters from 1990 to 2004	Average Number of Armed Conflicts per Year from 1990 to 2004	Expected Food Insecurity Level	Actual Food Insecurity Level
Mexico	20.8 million	Increased 14.2 million tonnes	52	0.4	Moderate	Low
Sri Lanka	2 million	Decreased -15.7 million tonnes	18	5.4	High	Moderate
Zambia	3.6 million	Decreased -15.9 million tonnes	9	0	Moderate	High

Data from FAO (2009) and Anderson and Valenzuela (2008)

For example, based upon the current theoretical explanations for food insecurity Mexico should have moderate levels of food insecurity. Though Mexico has increased overall production levels by 14.2 million tonnes from 1990 to 2004, it has experienced fifty two natural disasters including tsunamis along the Pacific coast, volcanoes and earthquakes in the central and southern regions, and hurricanes along the coast of the Pacific, Gulf of Mexico, and Caribbean (CIA World Fact Book 2009). Food insecurity levels, however, remained relatively low (i.e. averaging 194 kilocalories below daily requirement) (FAO 2009).

As another example, based upon the current theoretical explanations for food insecurity, Sri Lanka should be severely food insecure but it is not. From 1990 to 2004 Sri Lanka

experienced eighteen natural disasters, including the tsunami in 2004 that took more than 32,000 lives (Chester 2005). Further, production has stagnated over the past twenty years due mostly to an overall lack of investment in infrastructure by the Sri Lankan government (Yapa 1998). Furthermore, one of the largest impediments to food availability and access for the people of Sri Lanka has been the long-term civil war between the Sri Lankan government and the Liberation Tigers of Tamil Eelam since 1983 (CIA World Fact Book 2009). From 1983 to 2003, there were an estimated 460,000 Tamil, Muslim, and Sinhalese people displaced from their homes. The producers in the northeastern disputed region have been reluctant to cultivate rice, tea, onions and coconuts until political instabilities wane (Sahn 1988). Sri Lanka, however, has experienced only a moderate level of food insecurity (i.e. averaging 260 kilocalories below daily requirement) (FAO 2009).

Finally, Zambia has experienced high levels of food insecurity (i.e. averaging 310 kilocalories below daily requirement from 1990 to 2004), but current explanations suggest that it should not (FAO 2009). Zambia experienced a severe drought in 1991 and 1992, which destroyed major food crops, but it was able to offset the negative effects by importing emergency food aid almost immediately. Further, food production decreased -15.9 million tonnes from 1990 to 2004 due in large part to the drought in 1992 (when agricultural GDP declined by one-third) (Robinson et. al. 2007). Between 1990 and 2004, however, agriculture's contribution to Zambia's overall GDP grew between from 15 to 20 percent overall (FAO 2009; Robinson et. al. 2007). Furthermore, following the severe drought in 1992, Zambia abandoned any import controls to encourage the increase of imports on its markets. Thus the current explanations for food insecurity presented in the literature may need to be more fully examined to determine conditions under which food insecurity occurs.

This author builds upon literature in political economy, which focuses on rent-seeking political elites in developing states to attempt to address the puzzles in the literature. Doing so, this author argues that policy choices that reflect an anti-rural bias (i.e. discourage farmers from producing for domestic consumption) increase a state's level of food insecurity. The body of this thesis is divided into five sections. The first section provides a literature review of current explanations for food insecurity being offered across disciplines and discusses the limitations of each. The second section presents a theoretical framework. Specifically, it posits that certain policies that discourage production of import-competing goods increase the likelihood of food insecurity. The third section tests this theory using a quantitative study. The fourth section shows the findings of the quantitative study and discusses the implications of these findings. The fifth section concludes with the limitations of each model and discusses future research in the area of food insecurity.

CHAPTER 2

A REVIEW OF THE LITERATURE

Many different disciplines have explored the causes of food insecurity, including the fields of nutrition, physical and human geography, and economics (Maxwell and Slater 2004). Though each of these offers explanations for food insecurity in developing states, none can fully explain the cause of food insecurity. The field of political economy provides a framework for exploring the political motivations that mitigate or exacerbate the causes of food insecurity in developing states.

Nutritionists studying food insecurity argue that the failure of certain states to increase production levels may best explain the presence of food insecurity in those states. Though most nutrition literature concentrates on individual and household levels of food insecurity (Montgomery 1977), several scholars focus on state policies that encourage food access and affordability (McLaren 1978; Conway 1998; Pinstrup-Andersen et al. 1999; Rosegrant et. al. 2003). McLaren (McLaren 1978) addresses the state agricultural production policies on the domestic price of food. His logic is simple: as production increases, the cost of food will decrease. Thus to ensure that a state's citizenry can afford the food they need, it is necessary to implement policies that help to keep agricultural production increasing with demand.

Subsequent scholars in nutrition expanded upon this research, exploring which state policies encourage the greatest increases in production levels (Conway 1998; Pinstrup-Andersen et. al. 1999; Rosegrant 2003; Rosegrant and Cline 2003). Rosegrant and Cline (Rosegrant and Cline 2003) suggest policies that improve infrastructure, such as rural roads**,** can "increase agricultural production by bringing new land into cultivation and by intensifying existing land use" (1918). Broehl (1978) argues that research and development is essential for developing states to increase agricultural productivity. Magen (2008), in contrast, argues that policies aimed

at educating farmers in sustainable agricultural practices will allow them to gain the most crop yields from their land. Each suggests that food insecurity is a problem requiring state investment in improving production levels to compete with increasing demands.

The literature in both human and physical geography focuses on the devastating impacts of natural disasters to explain food insecurity. Droughts, floods, hurricanes, earthquakes, and other natural phenomena adversely affect a state's agricultural production. The Food and Agricultural Organization reported that extreme weather events worldwide decreased world cereal production from 2005 to 2007 by 3.6 percent (FAO 2008). Barnett et. al.'s work, "Vulnerability to Climate Variability and Change in East Timor", showed in their case study that in times of low rainfall maize production was reduced by almost 30 percent, "resulting in widespread hunger and child malnutrition" (2007).

Several human and physical geographers have studies the cyclical effects of human behavior on environmental degradation, which then in turn affects human welfare (Turner et. al. 1993a, 1993b; Turner and Meyer 1994, Liverman 1999). Liverman's work, "Geography and the Global Environment", discusses "how human activities contribute to changes in natural systems" which then have consequences on "the health and well being of humans and their institutions" (113). Whether one argues that natural phenomena have been exacerbated by human activity, many agree that natural disasters are the principal causes of changes in food insecurity levels.

Much of the literature in geography focuses on policies that target both short-term natural disaster management (e.g. embankments to prevent flooding) and long-term shifts in human behavior (e.g. emissions caps). Still many argue that these long-term measures are "too little too late" and that the effects of climate change on food production can only be mitigated through anticipatory efforts that focus on minimizing vulnerability in a state's food supply (Cutter 1996; Adger and Kelly 1999; Adger 1999, 2006).

Economists studying food insecurity suggest that agricultural protectionism in developing states contributed to high levels of food insecurity in those states. The economic literature addresses the growing interdependence between developed and developing states in agricultural trade and the effects such interdependence has on the developing states (Ghatak and Ingersent 1984; Anderson and Valenzuela 2008). Ghatak and Ingersent take a neoclassical economic view of food policy, suggesting that an integration of developing states' producers and consumers into an open economy of food trade would stimulate domestic food productivity and create stable food prices. Anderson and Valenzuela argue that "import restrictions to boost self sufficiency, far from helping, may even diminish food security for vulnerable groups struggling to pay the high price of protected domestic food" (2). These authors argue that protectionist policies prevent domestic producers from competing with importers. As a result, these producers do not invest the capital needed to produce efficiently and domestic consumers, meanwhile, must be burdened with the cost.

Though each of these fields offers contrasting explanations for food insecurity, none of these can fully account for the empirical observations of food insecurity observed in developing states. Nutritionists' explanation of food insecurity assumes that an increase in food production will result in an increase in availability and accessibility to the population. The Food and Agriculture Organization, however, suggests that an increase in food production is not enough to decrease hunger in developing states (FAO 2002). Though many developing states currently enjoy surpluses in food production (e.g. Tanzania and Uganda), nutritional indicators in these states reveal considerable food insecurity still remains for a large proportion of the population (USAID 1994, 2009). Thus an increase in production levels cannot fully explain whether or not food insecurity will occur in a developing state.

The occurrence of natural disasters does not necessarily result in food insecurity for every state. Peter C. Timmer suggests that "hurricanes and floods… can disrupt the smooth functioning of markets, and all in their wake can perish. But rich societies usually have the means to…alleviate such catastrophes" (Timmer 1997, 70). An example of this can be seen in the difference in impacts of the earthquakes in Chile and Haiti. The United Nation's World Food Programme (WFP) estimated that the Chilean earthquake released 500 times more energy than the earthquake that struck Haiti in January, but less than 1,000 people are thought to have died in Chile, as compared to the over 300,000 people who lost their lives in Haiti (WFP 2010). The WFP suggested that one of the main factors in avoiding such high death tolls following a natural disaster is a state's capacity to "prepare for, assess, and respond to hunger" (p.2). Thus state intervention may mitigate the effects of a natural disaster whereas insufficient state intervention during natural disasters can be disastrous. In *Poverty and Famines*, Amartya Sen argues that in the case of the Ethiopian famine of 1972, the failure of the state to distribute food aid effectively resulted in the death of 50,000 people (1982).

The political economy literature has attempted to explain the relationships between people and the food supply. In *Poverty and Famines*, Sen suggests that to understand starvation one must move beyond just the question of how food is supplied to questions of how it is distributed between different sections within a community. He explains that food production is one factor within a "network of relationships, and shifts in some of these relations can precipitate gigantic famines even without receiving any impulse from food production" (158). Thus, to understand how food is distributed between different sections within a community, Sen argues, one must understand the *entitlement relationships,* or the legal, economic, political and social characteristics operating within that society used to establish entitlements over that food (162).

Subsequent works in the political economy of food suggest that "public action" has a central role to play in eradicating famines and endemic hunger (Dreze and Sen 1991, Sen and Dreze 1999; Hollis and Tullist 1986). Jean Dreze and Amartya Sen's works continue the central argument of Sen's work that food insecurity is a result of a failure of people or groups of people to gain the entitlements they need. In their co-edited volume, *The Political Economy of Hunger*, these authors argue that market forces alone are not sufficient in explaining food insecurity outcomes (1991). Instead, political forces are central in determining entitlements of each sector of the population to food supply. In his chapter within this volume, titled "The Politics of Hunger and Entitlements", Rehman Sobhan identifies three determinants for food insecurity. The first two - direct entitlements (vary depending upon production conditions and capacities) and trade-related entitlements (reflecting terms of trade) – are more economic in nature. The third determinant, the contribution of the state to household entitlements, however, is more political in nature.

Whether or not this third entitlement is met involves major policies decisions concerning the mechanism for distributing food, the identification of beneficiaries, the means of financing government programs, and food pricing policies. Sobhan argues that a regime's "origins and ideology" determine whether or not that regime will implement policies guaranteeing food to certain populations. The underlying focus of the chapters within these volumes is that public action is needed to decrease a developing states' vulnerability within the global food market.

Tullis and Hollist argue in their edited volume, *Food, the State, and International Political Economy: Dilemmas of Developing Countries*, that governments in developing states are simultaneously charged with encouraging rapid economic development and providing an adequate food supply (1986). Though the two goals are potentially compatible, they argue that more often than not the goal of economic growth is pursued via strategies that encourage

industrial development, meanwhile neglecting rural development (xi). This urban bias, Tullis and Hollist suggest, leads to food insecurity for these states (xi). Raymond Hopkins, in his chapter within this volume, suggests that states can achieve food security by either producing the food they need, import the food they need, or some combination of the two (14). States that encourage industrial development, Hopkins argues, tend to tax the rural producer more thus discouraging domestic production (34). Thus Hopkins articulates the underlying assumption in Tullis and Hollist's argument that policy choices that neglect rural development will discourage domestic agricultural production and encourage imports. He argues that low domestic agricultural production levels are not worrisome if a state has the capacity to import the food it needs to account for the diminished production (14). Relying on imports for developing states is worrisome, he warns, as they have less capital available to buy the food needed should global prices spike (15). The underlying focus of these works is that each regime has different incentives that encourage or discourage the implementation of certain food policies. The political interests of the regime in power affect how a state will intervene in the food market.

Two seminal works that highlights how economic outcomes reflect political interests in developing states are Robert Bates' *Beyond the Miracle of the Market* and *Markets and States in Tropical Africa* (2005). In both works Bates challenges the neoliberal assumptions of markets as natural, self-correcting agents. In *Beyond the Miracle of the Market* he argues that political elites in a state create institutions to formalize their rent-seeking endeavors; these institutions and interests they represent shape the economic activity in that state (152-153). In *Markets and States in Tropical Africa* Bates argues that African governments, celebrating their newly won independence beginning in the 1960s, followed the development doctrines of the time that encouraged "industry as the engine for growth" (97). The economic interests of the coalitions

that came to power at the time varied, however, in the role they perceived agricultural would play in fostering that growth (122).

Urban coalitions of power tended to regard the agricultural sector as a potential revenue source. In a state where manufacturing is nascent, taxing the agricultural sector brought necessary resources from the countryside and channeled these resources into industrial development (123). Reflecting this mindset, coalitions formed in newly independent states in Africa most often had an urban, pro-manufacturing economic focus and the resulting political institutions. In contrast Bates argues, rural coalitions of power often are comprised of producers and thus have a strong economic interest in protecting domestic producers from market price (and thus income) fluctuations (122). Bates suggests that these groups also understood the need for industry growth but did not place the burden of revenue extraction on the producers. Instead, rural coalitions of power tend to place the burden of taxation on the consumers or find other sources of revenue such as mineral extraction (123). This, he argues, is what occurred in the case of Kenyan exceptionalism (128). The next section will build upon Robert Bates' argument, presented in *Beyond the Miracle of the Market*, highlighting that explanations for food insecurity in developing states reflect the economic and political interests of those in power.

CHAPTER 3

A THEORETICAL FRAMEWORK

Existing theoretical explanations may not fully explain when food insecurity occurs in developing states. Natural disasters inevitably disrupt crops and at times destroy infrastructure such as roads and rails needed to transport food from different parts of a state. Moreover the level of production does affect levels of food availability within a state, although increased levels of production do not always result in lower levels of food insecurity. Finally this thesis counters the neoclassical argument that agricultural trade distortions necessarily lead to an increase of food insecurity for developing states. Each of these factors must be viewed within a political economy lens. As mentioned in the previous section, the economic interests of those in power lead to specific policy choices. Thus to understand food insecurity outcomes, one must examine the interests of those in power and the food policies chosen based on these interests. This author argues that agricultural trade policies that discourage domestic production of food will increase the potential for food insecurity.

Economic Interests and Political Biases in Developing States

To determine the economic interests of a developing state, it is necessary first to determine what it means to be a developing state. At first blush this would seem be an easy task to accomplish; it is not as if there is no clear scholarly consensus. The World Bank generally uses material calculations (i.e. GNP per capita) to determine whether a state is developing or developed. According to its most recent classification, all states with a GNP per capita of 975 US$ or below are considered to be “low income” states. All states with a GNP annual per capita between 976 and 3,855 US$ are considered to be “lower middle income states” (World Bank 2009). The World Bank considers both low income and lower middle-income states to be

developing.[1] The United Nations, in contrast, uses both material and human resource indicators (e.g. life expectancy, literacy rates, etc.) to determine a state as developing (United Nations 2009).

Other definitions tend to place developing and developed states on a spectrum of industrialization (Bell and Pavitt 1993; Heady 2001). States are considered developed when they have achieved the process of industrialization (again a question of measurement can be debated). Developing states, thus, are those where industrialization has not begun, has just begun, or are industrializing but have yet completed the process. Two key assumptions made in this thesis are that developing states are pursuing the goal of rapid economic growth and are attempting to do so through increased industrialization. Both these assumption are supported in Bates' work, *Markets and States in Tropical Africa*. In his first chapter, Bates suggests, "like all nations in the developing world, the nations of Africa seek rapid development" (11). Further, Bates argues:

> Common sense, the evidence of history and economic doctrine all communicate a single message: that these objectives can best be secured by shifting from economies based on the production of agricultural commodities to economies based on industry and manufacturing (11).

If one adopts these underlying assumptions, then it may also be surmised that states need to extract revenue from sectors of the population not affiliated with industrialization (i.e. capital investing in industry and manufacturing and urban laborers) in order to assist in the industrialization process.

There are several ways in which a developing state can look for revenue to fund industrialization. One example of a source of state revenue can be natural resources (i.e. minerals, diamonds, tropical timber, and oil). Another example could be based upon that state's

[1] A list of historical classifications of states from the World Bank is available at http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20420458~menuPK:64133156~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html

strategic location (Moore 2004). Panama's government extracts tolls for use of the Panama Canal upwards of $19.80 per foot of draft for each vessel. The annual net income for the Panama Canal Authority is $992 million dollars (PCA's Annual Report 2009).

States that benefit from exportable natural resources and/or are strategically located are the exception rather than the rule. A final example of revenue extraction of developing states focuses on taxing the rural agricultural sector to finance urban industrialization. In most cases, a developing state must choose its source of revenue from non-industrial sectors of the population or from products being imported from abroad (i.e. import substitution industrialization). The theoretical framework that follows will concentrate on revenue extracted from both domestic producers and imports.

Robert Bates' work focuses on explaining why there is a tendency for urban bias within poor developing states and rural bias amongst richer states. His work is extremely important for political economists everywhere, especially those examining developing states. This theoretical framework will not explore the origins of a political regime or institution's rural or urban bias but concentrate instead on how policy choices that reflect either a rural or urban bias affect food insecurity outcomes.

Taxing Farmers: Agricultural Trade Policy Choices for Developing States

The research design will use an aggregated measurement (known as the nominal rate of assistance, or NRA) to capture the effects of trade and non-trade agricultural policies on both producers and consumers. Each of the policy choices discussed in this section, however, are agricultural trade policies. The reasons are two-fold. First, when a particular state implements an agricultural trade policy, that state wishes to protect either its urban or rural population from world agricultural prices. Thus domestic agricultural policy can be understood most directly by

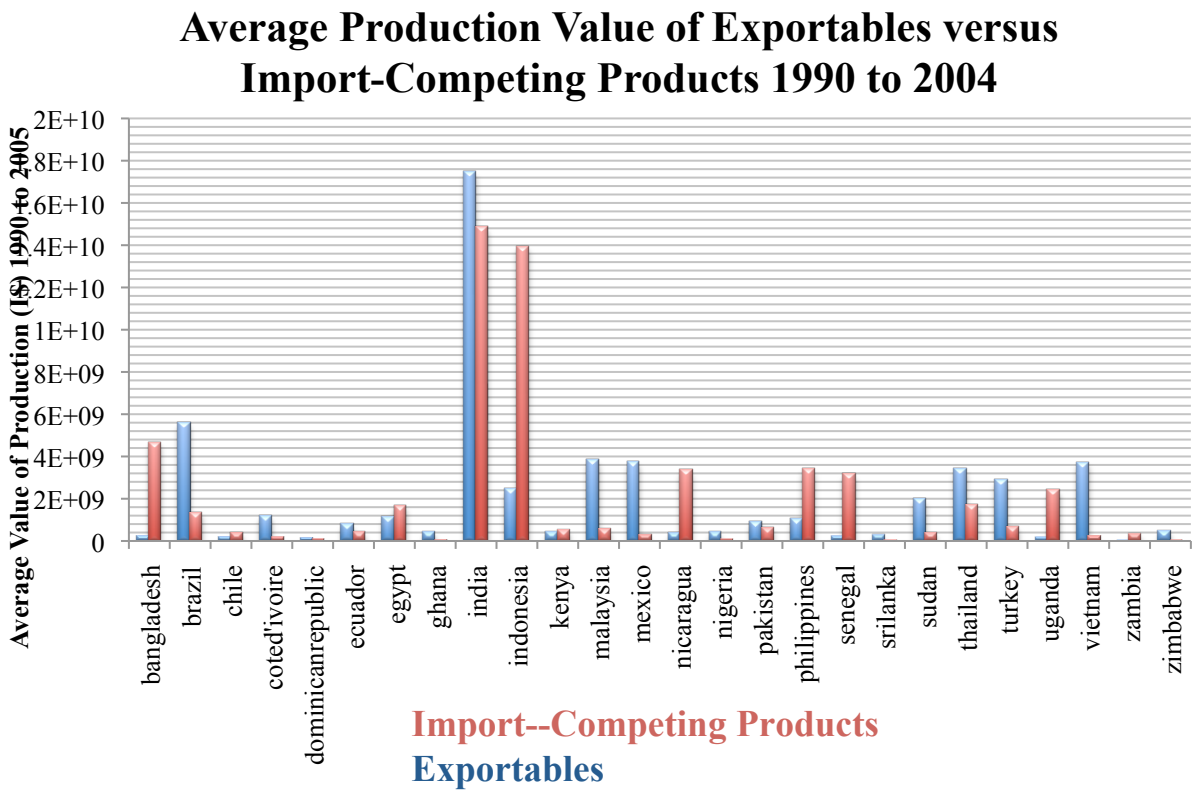
observing how a state responds to world market prices via its agricultural trade policy. Second, states' trade and non-trade agricultural policies tend to affect specific sectors of the population in similar ways. For example, both import and consumer subsidies lower the cost of products for the urban consumer. When a government implements import subsidies, it does so to encourage foreign producers to sell their products on the domestic market thus increasing competition and lowering costs. When a government implements consumer subsidies, it provides economic incentives to purchase goods or allows consumers access to government-produced goods. The effect, however, is the same. Thus, for simplicity, this section will address how price distortions affect sectors of the population by examining agricultural trade policies.

When a state wishes to industrialize and its political regime or institutions have an urban bias, it implements agricultural trade policies that are targeted at keeping food prices low for urban consumers and extracting revenue from exportable products. Agricultural trade policies that keep food prices low assist people in urban areas who are not able to grow all their own food. Lower food prices mean that people will be more likely to live and work in urban areas. Thus these policies help states attract and retain an urban labor force – a necessary component to industrialization.

Most often states wishing to keep urban food prices low do so by subsidizing food imports. An agricultural import subsidy is a trade distortion policy in which a government allows foreign producers or distributors to sell their products at a low price on the domestic market. Another way to avoid having to fund domestic food assistance programs is simply to allow foreign importers to compete against domestic producers, which increases competition and thus lowers food costs. Moreover the influx of foreign goods benefits consumers by driving down the prices of import-competing goods as well, and increases the selection of products on the domestic market.

When a state wishing to industrialize needs to extract revenue, however, it may do so by taxing products grown for export. The presence of an export tax naturally assumes that an exportable product has some relative advantage in the world market. When a state wishes to extract revenue from the agricultural sector, it may choose to implement an export tax for two reasons. First, exportable products tend to garner more revenue than products grown for domestic consumption (see Figure 2 below).

Figure 2



Anderson and Valenzuela (2008)

Second, exportable products are easier to regulate than products grown for domestic consumption. Agricultural export taxes are levied on products at a port or border before being exported. Thus these products are much easier to regulate than those grown domestically that

may be sold in farmer markets, on the streets, or in small-scale groceries. A state could also extract revenue from exportables through marketing boards.[2]

There are fewer cases in which states wish to industrialize and the political regime or institutions reflect a rural bias. When this does occur, the state implements agricultural policies aimed at taxing imports that compete with domestic production (Anderson 2009). The benefit of an import tax is that it provides the state with a revenue source outside the state assuming the foreign producers and distributors continue to sell goods on the domestic market once an import tax is levied. Further it has the benefit of being levied at ports and borders and is thus easily regulated. Most often states have imposed these taxes on industrial products in industrializing societies in an attempt either to achieve self-sufficiency or develop a strong export-based economy or on agricultural products in post-industrialized societies (Milner 1999). Less often have these taxes been used for agricultural imports in pre-industrialized societies. A discussion of the strengths and weaknesses of this approach follows below.

A final agricultural policy that reflects a political regime or institutions with a rural bias is an export subsidy. Far from a means of extracting revenue, an agricultural export subsidy assists in lowering the cost of a domestically grown crop so that it may be sold abroad at a competitive world market price. Export subsidies are implemented in two different scenarios. Most commonly, they are used by states that have already industrialized (i.e. developed states). Less commonly, they can be used in developing states if those states have a strong comparative advantage in producing a given export. In states that have already industrialized, the incentive to subsidize agricultural exports is to protect farmers from market prices to provide ample food for the large urban population, to offset the negative effects of export subsidies or import taxes of

[2] Though marketing boards in theory were created for producers to better market their products and thus increase their own income, some governments have used these institutions for rent-extracting purposes (i.e. purchasing exportables at certain prices from producers and then selling them for a higher price on the world market).

trading partners, or to maintain a rural producing population (Krugman 2007). In each of these cases the material cost of export subsidies is offset by some other welfare benefit. In states that have a strong potential comparative advantage in producing a given exportable, by subsidizing this product the state assumes that the material costs of subsidizing will be offset by material benefits for the export producer. In some examples this may increase overall welfare but in others it may only reflect the parochial interests of those in power.

How Agricultural Trade Policies Affect Domestic Food Production Levels

Each agricultural trade policy (import subsidy, export tax, import tax, and export subsidy) affects different parts of the population (see Table 2 below). The different sectors of the population potentially affected by trade distortion policies within a developing state include: urban consumers, producers of food for domestic consumption, and producers of food for export. This explanation excludes rural consumers because of the assumption that a rural consumer and producer are one and the same.

Agricultural import subsidies decrease food prices for consumers. Though these subsidies do not directly raise revenue for the state, by keeping cost of food low for the urban consumers, they assist in keeping a ready labor pool to aid industrial growth. Whereas these policies positively affect consumers, however, they negatively affect import-competing agricultural producers and thus may discourage them from producing.

Table 2: Sectors of the Population Affected by Trade Distortions

Distortion/Sector	Import Subsidy	Export Tax	Import Tax	Export Subsidy
Import-Competing Producer	Negative	Neutral	Positive	Neutral
Exportable Producer	Neutral	Negative	Neutral	Positive
Urban Consumer	Short-term Positive/ Long-term Negative*	Neutral	Negative	Neutral

* Import subsidies may benefit consumers in the short term by providing lower prices and a larger selection; however, in the long-term this thesis argues that import subsidies are likely to increase the level of food insecurity in a state.

Agricultural export taxes will have no direct effect on urban consumers, though they may benefit indirectly as urban laborers since the state reallocates revenue from rural agricultural to urban industrialization. Further, agricultural export taxes will have no direct effect on import-competing agricultural producers. These policies will, however, negatively impact the exportable producers who will have less incentive to produce. Thus this thesis posits that agricultural export taxes will discourage the production of exportable goods.

In the case of agricultural import taxes, these policies will negatively impact urban consumers as they will have to pay higher prices for their food than the world market value. These policies, however, will positively affect import-competing agricultural producers who will be able to sell their products at higher prices. Thus these producers will be encouraged to increase the production of import-competing goods. Finally, agricultural export subsidies should not have any real impact on urban consumers in developed or developing states.

In developed states, agricultural export subsidies may mean that the states extracts revenue from the industrial sector but as this sector is fully established the effects would not be

great. Likely these policies would not affect the urban consumers' food prices and may only minimally affect wages over time. In pre-industrialized developing states the urban dweller's food prices would not increase or decrease because of export subsidies. Furthermore, the urban worker may benefit from export subsidies were they to work within a sector that packaged or processed agricultural products for export. Lastly, export subsidies should have little impact on the import-competing producers directly.

Domestic Food Production Levels and Food Insecurity

This thesis argues that the presence of agricultural trade policies that discourage production for domestic consumption in a developing state (e.g. import subsidies) can best explain the presence of food insecurity for that state. If a state discourages producers from growing crops for domestic consumption, then it will have to rely on imports to feed the population. Thus, as mentioned above, short term this is advantageous for the urban consumer as it offers more selection and food at lower prices. This logic assumes that there is enough food available and affordable to feed everyone in a given state. If, however, a state is unable to import the food it needs, there will be insufficient amounts of food grown domestically to feed the population.

When is a state unable to provide its citizenry with the food it needs? The first case is when a state cannot import the food it needs. A very recent example of this occurred in the 2010 earthquake in Haiti. Haiti is an import-dependent developing state and the recent earthquake damaged infrastructure essential for the distribution of food to the population within and beyond the capital, Port-au-Prince.

A second case in which a state is unable to import the food it needs is when it cannot afford to do so. The global food shortage in the early 1970s, brought about by the compounded

effects of rising transportation prices and massive crop failures in the Soviet Union, resulted in a global spike in food prices (Friedmann 2002; Anderson 2009). Though developed states were able to afford basic food needs, developing states were not and therefore localized, widespread starvation ensued (Friedmann 2002).[3] Though import subsidies may benefit consumers in a given state in the short-term, over the long-term these consumers will become more vulnerable to shocks in the global food market and increasingly susceptible to food insecurity. In contrast, the presence of agricultural trade policies that discourage or encourage the production of exportable goods (i.e. export taxes and subsidies) may affect the socio-economic welfare of export producers. This thesis, however, does not suggest that these policies will affect food insecurity levels for a given state.

Finally, the presence of agricultural policies that encourage the production of import-competing goods (i.e. import taxes) should decrease the level of food insecurity in a state. This proposition rests on several key assumptions. The first assumption is that if given the incentive to produce, the import-competing agricultural producers can and will feed the entire population of their state. This assumes that the import-competing prices are higher than imported products but not too high so as to be unaffordable. The likelihood of costs rising this high is mitigated by the incentive and ability of the state to prevent this eventuality.

Hypotheses

In summation, this section argues that agricultural policies that discourage domestic production in developing states may help to explain the presence of food insecurity. From this argument, I generate two main and null hypotheses. The first expresses the relationship between agricultural policies and production levels for import-competing goods:

[3] For more information about the global food crisis see Paarlberg 1980; Rankin 1980; Lundborg 1987

H1: Increases in agricultural import subsidies will decrease production levels of domestic goods that compete with imports.

The null hypothesis would be:

N1: Increases in agricultural import subsidies will have no relation to production levels of domestic goods that compete with imports.

The second expresses the relationship between import-competing production and food insecurity levels within that state:

H2: Low production levels of domestic goods that compete with imports will increase food insecurity levels.

Thus the null hypothesis for this would be:

N2: Low production levels of domestic goods that compete with imports have no relation to food insecurity levels.

As the literature review illustrates, there are alternative explanations that scholars believe matter most in determining when food insecurity occurs. This study does not assume a primary causal factor for food insecurity but suggests that *increases in agricultural import subsidies* may be an important additional factor in explaining food insecurity. The first set of alternative hypotheses below suggest other explanations for lower production levels in a developing state:

A1: The presence of conflict in a developing state matters most in explaining lower production levels for that state.

A2: The presence of natural disasters in a developing state matters most in explaining lower production levels for that state.

The second set of alternative hypotheses below suggest other explanations for an increase in food insecurity levels in a developing state:

A3: The presence of conflict matters most in explaining an increase food insecurity levels.
A4: The presence of natural disasters matters most in explaining an increase food insecurity levels.
A5: Little access to clean water matters most in explaining an increase food insecurity levels.
A6: Little improvement in sanitation matters most in explaining an increase food insecurity levels.
A7: A less democratic regime type matters most in explaining an increase food insecurity levels.

The next section empirically tests this argument using two linear regression models.

CHAPTER 4
THE RESEARCH DESIGN

Hypotheses Testing

Heretofore, this thesis has explored existing theoretical explanations for food insecurity and presented a complementary theoretical argument. This section will empirically test these complementary theories of food insecurity. To review, this thesis argues that the presence of trade distortion policies in a developing state that discourage domestic production is a major factor in explaining when food insecurity occurs. This argument generates two main hypotheses:

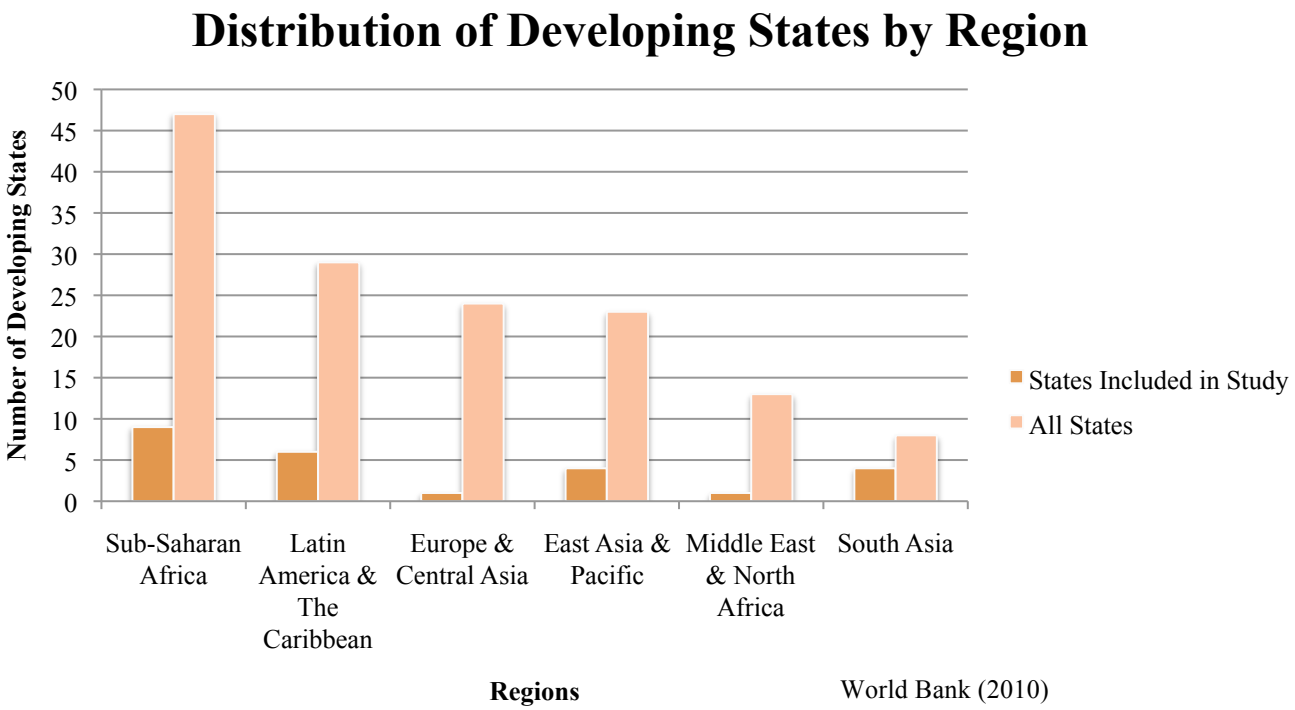
H1: Increases in agricultural import subsidies will decrease production levels of domestic goods that compete with imports.

H2: Low production levels of domestic goods that compete with imports will increase food insecurity levels.

To test the above hypotheses, this author will conduct a quantitative study. The study includes two large *n* statistical models. Models one focuses on twenty-seven of the one hundred and four states determined to be "low-income", "lower-middle-income", and "upper-middle-income economies" by the World Bank (2009). This model examines the states from 1990 to 1992, 1994 to 1997, and 2002 to 2004. Model two focuses on twenty-five of these states and examines these states from 1990 to 1992, 1995 to 1997, and 2002 to 2004.[4] A list of these states is included in the index. These states are representative of all developing states in terms of geographical location and GNP per capita income levels (see Figures 3 and 4 below).

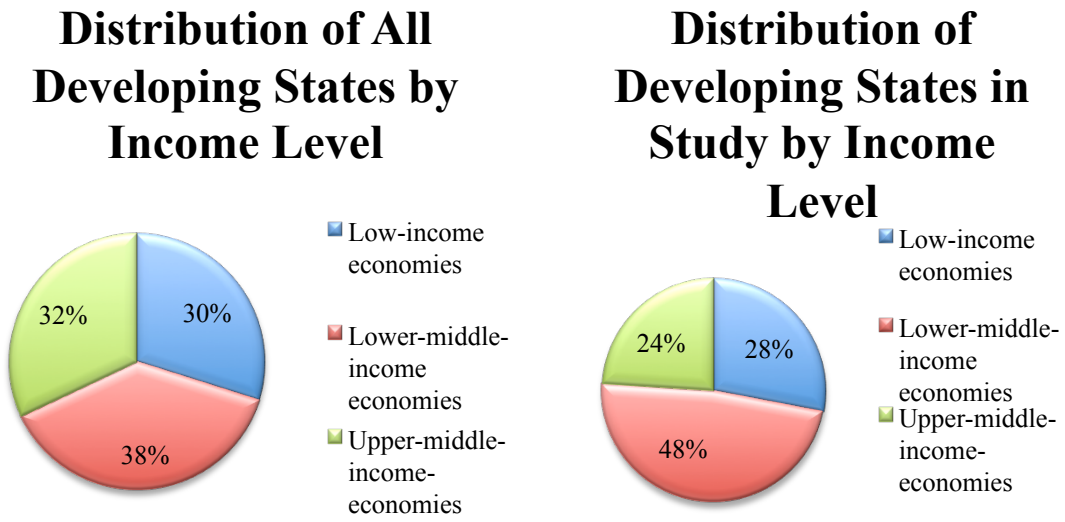
[4] Discrepancies between the two models is due to availability of the data.

Figure 3



World Bank (2010)

Figure 4



World Bank (2010)

Figure 3 indicates that the study may include more Middle Eastern and North African states than and too few European and Central Asian states to accurately representative the geographic distribution of developing states. Further, Figure 4 indicates that the study may include more middle-lower income economies than is accurate. Both figures, however, demonstrate that this study is a generally accurate representation of the geographic and GNP per capita income level distributions of developing states.

Both models in this study focus on these states from 1990 to 2004. Because of data availability, however, this study could not capture data for each year. Instead, data are gathered from 1990 to 1992, 1995 to 1997, and 2003 to 2004.[5] Each model is a simple linear regression and thus will only test for correlation. It presents both unlagged and lagged independent variables in the results.

Model One ~ Policy Distortions Effects on Production Levels

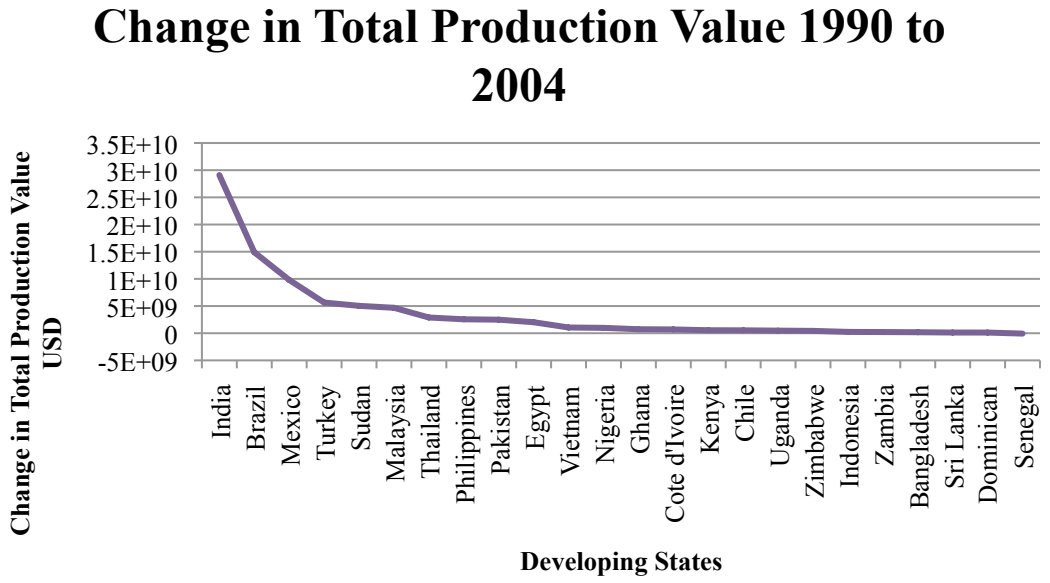
Model one tests the correlation between agricultural trade policies and domestic agricultural production levels. The hypothesis for model one is that policies that *decrease* incentives for producers will result in a *decrease* in production levels. For this model, the unit of analysis will be *country_product_year*. By focusing on individual products grown within a state, this study can test how regulations of specific products affect those products' production levels. See Table 3 for a complete list of products included.

Dependent Variable: The dependent variable for this model is change in production level. Data included are from Anderson and Valenzuela's "Estimates of Distortions to Agricultural Incentives, 1955 to 2007" dataset compiled for the World Bank (2008). To measure the change in production level for each country_product_year, this study uses the value of production

[5] The FAO's food insecurity data is only available for these years.

(undistorted farmgate price in USD) for products grown within twenty-seven states from 1990 to 1992, 1995 to 1997, and 2002 to 2004. This is not a comprehensive list of all products grown in these states. Instead, Anderson and Valenzuela include only twenty-seven of the "most common" food products. These twenty-seven products are considered the "most common" based upon two assumptions. First, they have been produced on an international scale for at least the last half-century. Second, the combined share of these products in global agricultural production from 2000 to 2004 was 56 percent. These crops include: five grains (includes cassava), eight fruits and vegetables, seven meat and dairy products, and seven products for oils and fats (e.g. palmoil). This study includes only products grown from 1990 to 2004. Thus, if a product was grown temporarily (for example from 1992 to 1995) it was not included. Figure 5 below shows the distribution of production values across state and across the time period (1990 to 2004). The variable is calculated by subtracting the overall production value for a given product in a state in a given year from the overall production for that same product the previous year.

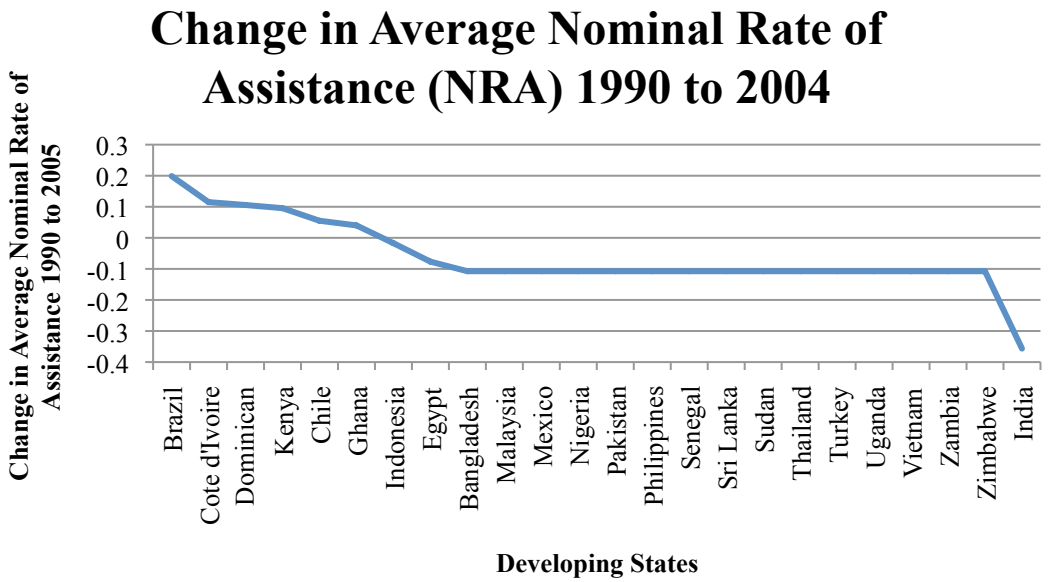
Figure 5



Anderson and Valenzuela (2008)

Independent Variable The independent variable for model one is policy distortions to agricultural incentives. To operationalize this variable, this study uses the nominal rates of assistance (NRA) by product from Anderson and Valenzuela's "Estimates of Distortions to Agricultural Incentives, 1955 to 2007" dataset. The nominal rate of assistance is the "percentage by which government policies have raised gross returns to farmers above what they would have been without the government's intervention (or lowered them, if NRA<0)" (Anderson et. al 2009, 5). Thus the nominal rate of assistance incorporates price distortions from both trade and non-trade policies. If the nominal rate of assistance is negative, government agricultural policies are decreasing agricultural incentives. Conversely if the nominal rate of assistance is positive, then government agricultural policies are increasing agricultural incentives. The nominal rate of assistance for all products across time varies from 3.9 to -0.95 and 0.038 is the average (see Figure 6 below). For hypothesis one to be supported, a *decrease* in the nominal rate of assistance must be significantly correlated with a *decrease* in production.

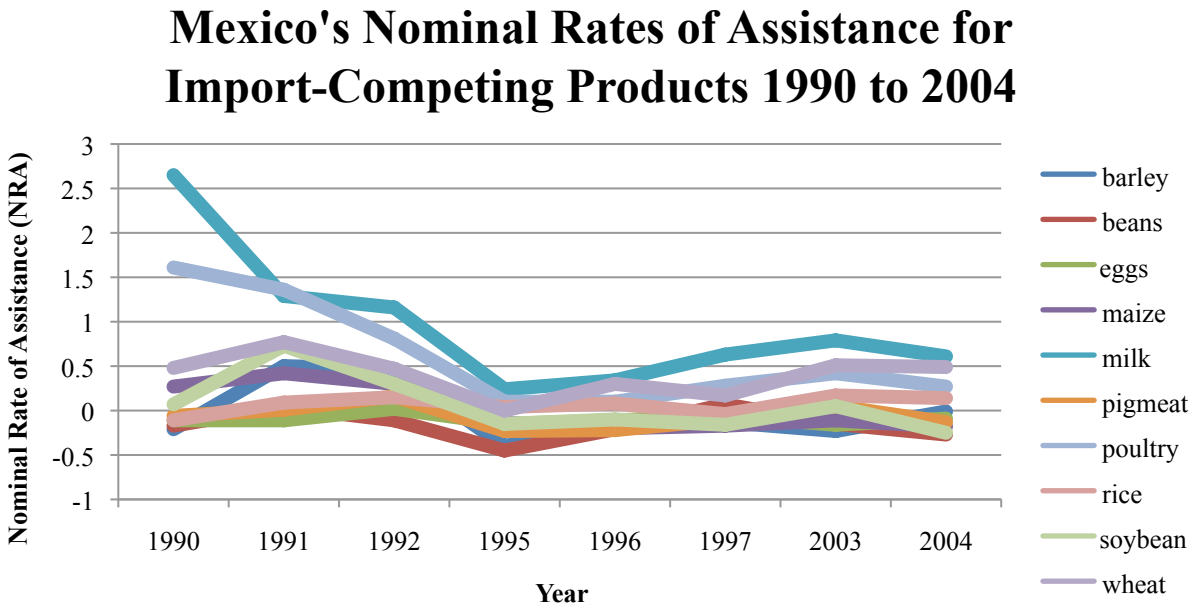
Figure 6



Anderson and Valenzuela (2008)

For the three states mentioned in the introduction - Mexico, Sri Lanka, and Zambia - the nominal rate of assistance varies widely both among these states and across products. For simplicity, these figures below only include products grown for domestic consumption. Figure 7 shows that Mexico has a larger number of import-competing products than Sri Lanka and Zambia.

Figure 7



Anderson and Valenzuela (2008)

Prior to 1995, the nominal rates of assistance varied across products in Mexico. Producers of milk and poultry saw a larger percentage of gross returns than they would have received otherwise. For four of the ten products (beans, rice, eggs and barley) producers saw either no assistance or smaller gross returns than they would have received otherwise. Throughout the early 1990s Mexico began to implement policies that lowered the percentage of gross returns to farmers. This trend resulted most likely from the passage of NAFTA in 1994 (Yunez 2002; Hanson 2003). Since 1995, the nominal rates of assistance have become less

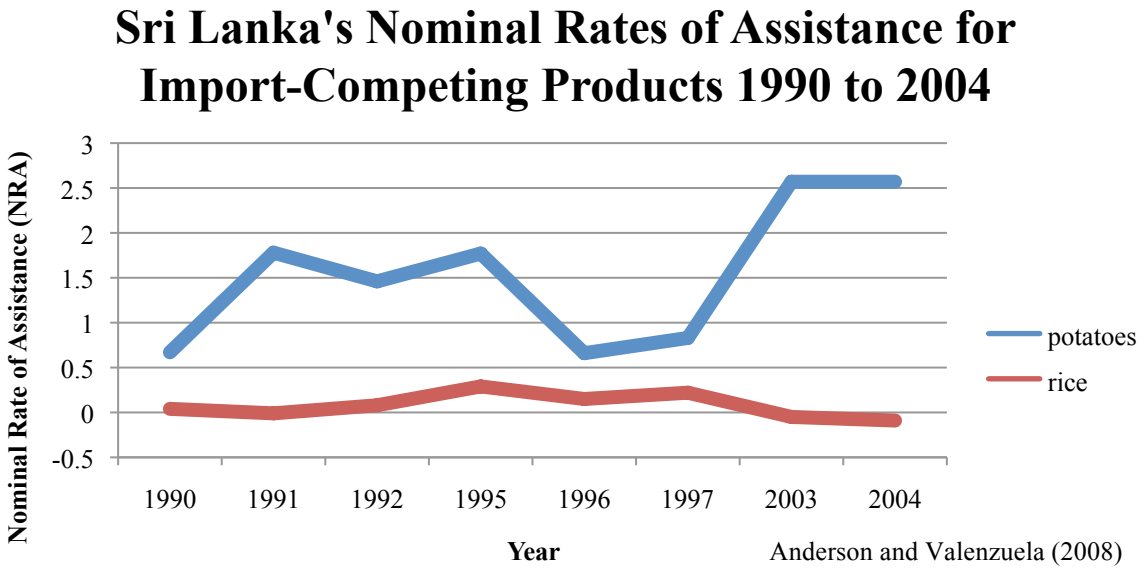
varied across products, remaining just above or below zero. This reflects the overall trend toward liberalization of Mexico's agricultural sector (Yunez 2002).

Sri Lanka produces significantly fewer products for domestic consumption than Mexico. From 1990 to 2004, domestic producers have grown and sold potatoes and rice on the domestic market. What is most notable about the Sri Lanka case is the difference in the nominal rate of assistance between potato and rice production (see Figure 8). Producers growing potatoes have seen a 0.66 to 2.57 percentage of gross returns. In contrast, producers growing rice have seen a 0.29 to -0.09 percentage of gross returns. In Bandara and Jayasuriya's work, "Distortions to Agricultural Incentives in Sri Lanka", they show that policy reforms have been both limited and selective in the import-competing parts of the agricultural sector (2007). These authors explain that the low assistance to rice producers is linked directly with the domestic demand for rice. Bandara and Jayasuriya speculate that as long as rice remains a staple for Sri Lankans, "the level of direct price protection will…be constrained by the need to keep an eye on consumer interests" (26). In contrast, they argue that potato production has been a relatively small-scale operation. From 1990 to 2004 the average value of potato production in Sri Lanka was $18.5 million while the average value of rice production was $384 million.

Further, these authors argue that potato producers increased their production in the southern regions of Sri Lanka as fighting in the north and eastern parts of the state disrupted agricultural production for the Tamil producers. They argue that the success of potato production as well as other "minor food crops" in the south has been the result of a small number of Sinhalese producers exercising political clout along regional and ethnic lines. Bandara and Jayasuriya argue that the consumer resistance to high potato prices has been "largely ignored" (25). They argue, however, that "the near-complete marginalization of Tamil farmers in the

North and East from mainstream political life" has resulted in the diminishing role of ethnicity in agricultural policy formulation (25).

Figure 8



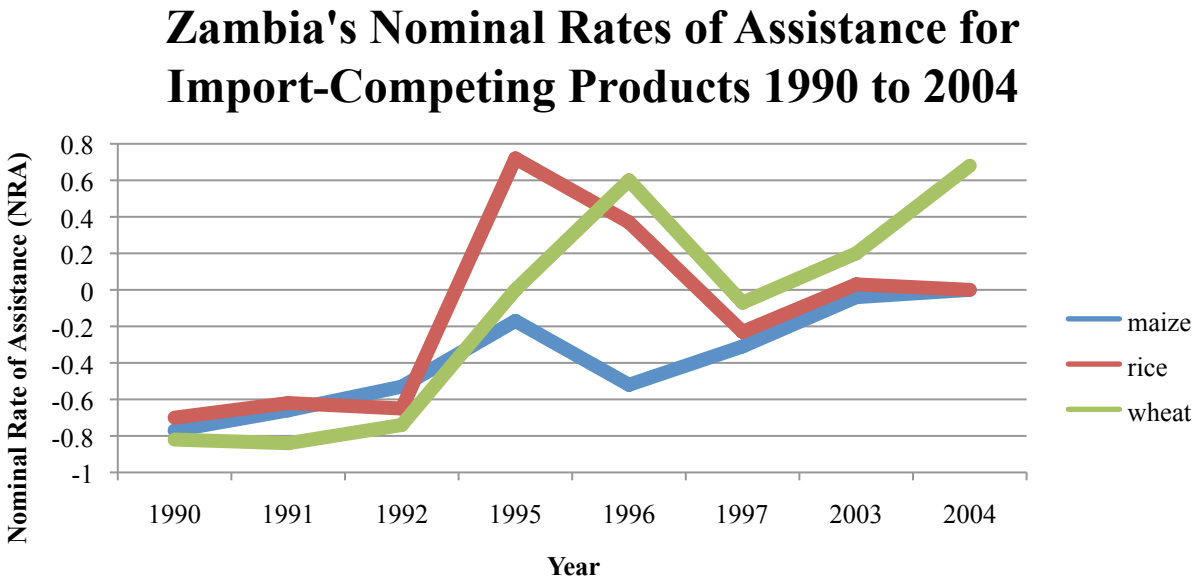
Anderson and Valenzuela (2008)

In Zambia three products are grown for mass domestic consumption: maize, rice, and wheat (Figure 9). Producers of these products have faced extreme changes in the nominal rate of assistance between 1990 and 2004. The nominal rate of assistance for maize has varied from -0.77 percent in 1990 to -0.04 percent in 2003. The nominal rate of assistance for rice started at -0.07 percent in 1990, rose to 0.72 percent in 1995, and dropped to 0.03 percent in 2003. And the nominal rate of assistance for wheat began at -0.84 percent in 1990, rose to 0.6 percent in 1996, dropped to -0.07 the following year, and then rose sharply to 0.68 by 2004.

Robinson et. al.'s work, "Distortions to Agricultural Incentives in Zambia", explains that the initially negative NRAs across products were not surprising considering Zambia is a "country where the power base of the ruling party is drawn from the urban areas" (2007, 12). These negative are also the result of the Zambian government implementing import subsidies following severe drought and crop failures in 1991 and 1992. What is most notable is that Robinson et. al.

explain the significant upward trend in the nominal rates of assistance after 1992 was not the result of agricultural policy changes but rather due to the Zambian government's "half-hearted approach to liberalizing agricultural markets" (10). Once the worrisome effects of the drought had subsided, the Zambian launched various agricultural reform programs to further liberalize the market, but "these reform programs were not carried through with the vigor that was needed" and "tended to redistribute wealth to relatively well-off farmers, rather than to expand agricultural output" (21).

Figure 9



Anderson and Valenzuela (2008)

A glance at the nominal rates of assistance for Mexico, Sri Lanka, and Zambia illustrates that the government's motivation for these assistances and the products they choose to target vary depending upon domestic (and at times, international) political factors. Table 3 below presents the average nominal rate of assistance and average production values for products across time and state. This table shows that, though production values and nominal rates of assistance may be caused by different political motivations, the affects of these are comparable.

Thus the affects of the nominal rates of assistance on production value can be compared across products.

Table 3: Average NRA and Production Values for Products Across Developing States in Study

Product Across States	Average Nominal Rate of Assistance	Average Production Value	Import-Competing/Exportable
Apple	-0.016	$344,619,974	Exportable
Banana	0.013	$270,516,891	Exportable
Barley	0.001	$350,094,974	Both
Beans	-0.066	$140,824,398	Both
Beef	-0.051	$854,062,209	Both
Camel	-0.220	$129,469,930	Exportable
Cassava	-0.261	$614,725,000	Exportable
Coconut	-0.132	$1,004,325,000	Exportable
Egg	-0.058	$716,137,500	Import-Competing
Grape	0.029	$445,862,500	Exportable
Groundnut	-0.060	$24,939,860	Exportable
Hazelnut	-0.143	$770,212,500	Exportable
Maize	-0.047	$480,896,504	Both
Milk	-0.044	$932,462,570	Both
Millet	-0.090	$36,750,000	Exportable
Palmoil	-0.108	$1,171,416,480	Both
Pigmeat	-0.123	$797,587,319	Both
Potato	0.094	$134,192,689	Both
Poultry	-0.044	$383,195,979	Both
Rapeseed	-0.056	$1,685,311,941	Import-Competing
Rice	-0.045	$951,669,864	Both
Sesame	-0.143	$22,154,895	Exportable
Sheepmeat	-0.239	$1,102,593,750	Exportable
Soybean	-0.068	$620,600,753	Both
Sunflower	-0.137	$140,545,654	Import-Competing
Tomato	-0.077	$993,345,647	Exportable
Wheat	-0.040	$372,758,075	Import

Anderson and Valenzuela (2008)

Control Variables: When conflict takes place within a given state's borders, it could potentially disrupt the production of agricultural goods. As noted above, one alternative hypothesis for this model is: the presence of conflict in a developing state matters most in explain lower production levels for that state. For this alternative to be supported, the *presence* of a conflict must be significantly correlated with a *decrease* in production. To measure this variable, the Correlates of War Militarized Interstate Disputes (MID) dataset was used (Sarkees

2000). This variable counts the number all violent uprisings, civil wars, and interstate wars in which disputes took place within the given state's borders. On average number of conflicts across state and year for the developing states included in this study is 5.5. The most conflicts a state experienced in a year is twenty-nine.

Many scholars argue that the occurrence of natural disasters (i.e. severe drought, floods, hurricanes, etc.) adversely affects a state's agricultural production. The second alternative hypothesis for this model is the presence of natural disasters in a developing state matters most in explaining lower changes in production levels for that state. For this to be supported, the *presence* of a natural disaster must be significantly correlated with a *decrease* in production. To measure whether states have experienced a natural disaster, this research design includes data from the International Emergency Disasters Database (EM-DAT) (2009). EM-DAT includes a natural disaster in its dataset if: (i) ten or more people have been reported killed, (ii) one hundred or more people have been reported affected, (iii) the state had to declare a state of emergency, and (iv) the state called for international assistance. This study measures the numbers of natural disasters that occurred in a given state. On average the developing states in this study experienced 3.9 natural disasters in a fifteen-year period.

Findings for Model One

The findings for model one are listed in Table 4 (below). For model one the independent variable is not statistically significant and the negative coefficient estimates for trade distortion seems opposite than what was predicted. These findings show that a decrease in the nominal rate of assistance is correlated with an increase in a change in production levels controlling for natural disasters and conflict. Thus for a ten percentage point decrease in the nominal rate of assistance (i.e. removing policies that protect farmers so that their income would be ten percent

lower than the previous year), the overall production value would increases by $6.65 million holding all other variables constant. Tables 5 and 6 (below) illustrate how changes in NRAs can affect Mexico, Sri Lanka and Zambia's expected production values for import-competing products.

Table 4: Model One

How Policy Distortions' Affects Changes in Production Levels

Explanatory Variable	Change in Production Level	Change in Production Level (lagging NRA one year)
Level of Trade Distortion (NRA)	-6.65e+07 (3.70e+07)	-0.1803*** (0.435)
Conflicts	1,421,286 (3094821)	443097 (14508836)
Natural Disasters	2.62e+07 (5018201)	3.15e+07*** (7745976)
Constant	-1.63e+07 (3.37e+07)	-5.20e+07 (4.66e+07)
Observations	882	495
R^2	0.03	0.06

Standard Errors are in parenthesis.
Statistical significance is noted with ***p<0.001, ** p<0.005, * p<0.01.

When the effects of trade distortion policies are lagged one year, the relationship is statistically significant although still not in the predicted direction. Instead, the findings show that for a ten percentage point decrease in the nominal rate of assistance, the overall production value would increases by $183,000 holding all other variables constant. As Table 6 illustrates there may be significant difference in production levels between the first year that a nominal rate of assistance is decreased by ten percentage points and the following year that it is decreased by another ten percentage points. This model may be capturing the shifting response of farmers to a decrease in nominal rates of assistance. Following the first decrease in the nominal rate of assistance farmers

may be increasing production so as to offset the expected decrease in income this decrease will bring. If, however, a state continues to decrease its nominal rate of assistance to farmers, it may be impossible for the farmers to match the production levels necessary as they would have were the nominal rate of assistance not to have been decreased. Thus, as other scholars have argued, trade liberalization may lower incomes for subsistence farmers disproportionately to other farmers (Moore 1990; Winters 2000; Winters et. al. 2004). Robert Moore's "Can Trade Liberalization Lead to an Increase In Poverty in Central America?" argues that trade liberalization increases the inequality of the distribution of income and increase the incidence of poverty among the lowest earning farmers as they are more sensitive to market shocks (9). A future study should empirically test the effects of trade policies on changes in production levels over a longer period of time.

The relationship between the presence of conflict and changes in production levels failed to reach statistical significance and but was in the predicted direction for both the lagged and unlagged models (i.e. the greater the presence of conflict, the greater the change in production levels). Subsequent testing should examine whether conflict increases of decreases production. The relationship between the presence of natural disasters and changes in production levels failed to reach statistical significance in the unlagged model but was highly significant in the lagged model. This finding suggests that a natural disaster may not destroy production levels of crops in the given year as they may have already been harvested but will affect the production levels of crops already planted for the following year.

Table 5: Expected Production Values for Import-Competing Products Grown in Mexico, Sri Lanka, and Zambia

State	Product	Production Value 2004 (USD)	Expected Production Values in 2005 (USD) With a Ten Percentage-Point Decrease in NRA, holding all other variables constant at their means
Mexico	Barley	$182 million	$188.67 million
	Beans	$828 million	$834.67 million
	Eggs	$1.94 billion	$1.947 billion
	Maize	$3.9 billion	$3.907 billion
	Milk	$1.54 billion	$1.547 billion
	Pigmeat	$2 billion	$2.007 billion
	Poultry	$2.5 billion	$2.507 billion
	Rice	$54.6 million	$61.2 million
	Soybean	$25.8 million	$32.45 million
	Wheat	$414 million	$421 million
Sri Lanka	Potatoes	* $9.77 million	$16.42 million
	Rice	$382 million	$389 million
Zambia	Maize	* 203 million	$210 million
	Rice	* $1.44 million	$8.09 million
	Wheat	$25 million	$31.65 million

*Due to missing data for 2004 substituted production value from 2003 Anderson and Valenzuela (2008)

Table 6: Expected Production Values for Import-Competing Products Grown in Mexico, Sri Lanka, and Zambia Lagging NRA One Year

State	Product	Production Value 2004 (USD)	Expected Production Values in 2005 (USD) With a Ten Percentage-Point Decrease in NRA, holding all other variables constant at their means	Expected Production Values in 2006 (USD) With a Twenty Percentage-Point Decrease in NRA from 2004, holding all other variables constant at their means
Mexico	Barley	$182 million	$188.65 million	$188.83 million
	Beans	$828 million	$834.67 million	$834.85 million
	Eggs	$1.94 billion	$1.947 billion	$1.947 billion
	Maize	$3.9 billion	$3.907 billion	$3.907 billion
	Milk	$1.54 billion	$1.547 billion	$1.547 billion
	Pigmeat	$2 billion	$2.007 billion	$2.007 billion
	Poultry	$2.5 billion	$2.507 billion	$2.507 billion
	Rice	$54.6 million	$61.2 million	$61.38 million
	Soybean	$25.8 million	$32.45 million	$32.63 million
	Wheat	$414 million	$421 million	$421.18 million
Sri Lanka	Potatoes	* $9.77 million	$16.42 million	$16.6 million
	Rice	$382 million	$389 million	$389.18 million
Zambia	Maize	* 203 million	$210 million	$210.18 million
	Rice	* $1.44 million	$8.09 million	$8.27 million
	Wheat	$25 million	$31.65 million	$31.83 million

* Due to missing data for 2004 substituted production value from 2003 FAO (2009)

Model Two ~ Changes in Production Levels Effects on Food Insecurity

Model two tests the correlation between changes in domestic agricultural production levels and food insecurity. The hypothesis for model two is that policies that result in *low* changes in production levels of domestic goods that compete with imports will explain an *increase* in food insecurity levels. For this model, the unit of analysis will be *state_year*. This model includes twenty-five states from 1990 to 1992, 1995 to 1997 and 2002 to 2004.

Dependent Variable: Low changes in production levels for import-competing goods will increase food insecurity levels. The dependent variable for model two is food insecurity. To review, the conceptual definition of food insecurity is a "situation that exists when people lack physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO 2000b). This conceptual definition of food insecurity presents several problems. First, it includes potential causes of the food insecurity (i.e. lack of physical, social, and economic access) in the definition. Secondly, it uses terms such as "food preferences" which vary from individual to individual as well as from culture to culture and thus are extremely difficult to concretize. In order to operationalize food insecurity and maintain statistical rigor, this thesis will rely upon the measurement of food insecurity as a situation in which the intake of food for a given population does not meet their dietary needs.

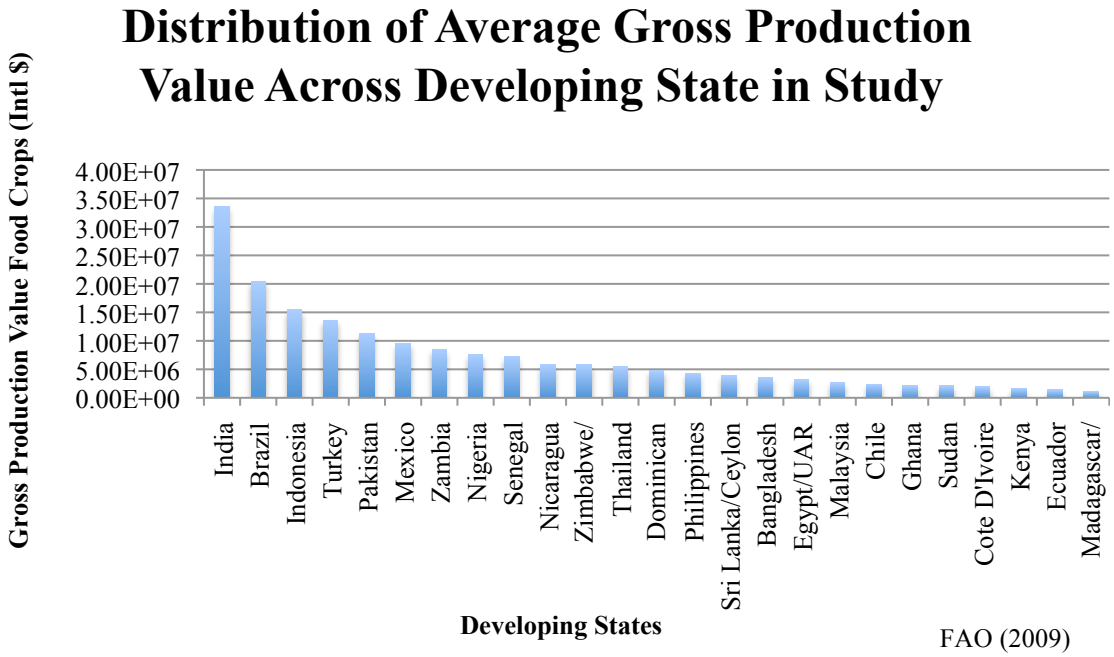
To operationalize this stripped-down version of food insecurity, this study uses the Food and Agricultural Organization's (FAO) "Intensity of Food Deprivation Index, 1990 to 2005" (2009). This index compares the dietary energy intake of the undernourished population in a state to the average minimum daily dietary energy requirement for that state. The FAO defines the "undernourished" as those whose dietary energy consumption is "continuously below" the minimum dietary energy requirement. The minimum dietary energy requirement is the average

amount of calories needed to carry out a light physical activity in a day while still maintaining one's health (it varies depending on height and body weight). Both the dietary energy intake of the undernourished population and the minimum daily dietary energy requirement are measured in kilocalories (or commonly understood to be food calories). The index is found by subtracting the dietary energy intake of the undernourished population from the minimum daily dietary energy requirement for each state. Thus, the variable is continuous with zero representing a measurement in which the dietary energy intake of the undernourished population equals the average minimum dietary energy requirement for a state (i.e. food security). This variable is not an ideal measure for food insecurity at the state level because the measurement captures only the degree to which the *undernourished* population in a state experiences food insecurity and not the entire population. This data, however, is the most commonly used in food insecurity studies at the state level and must serve as a proxy without a better measurement.

Independent Variable: The independent variable for this second model is change in production level. This study used data from the Food and Agricultural Organization's "Production Indices" dataset. This dataset measures gross food production values (by 1000 international dollars). Production quantities for each commodity produced in a state are weighted by the international price for the average international commodity price and then added together to create an overall food production measurement. As international commodity prices are not available for every year, the FAO dataset estimates the international commodity price from 1990 to 1998 and 2002 to 2004 based upon the average prices from 1999-2001. Amounts of seed and feed are subtracted from the production data to avoid double counting them as they are already counted with the crops or livestock that originally produced them. All crops and livestock products are included with the main exceptions of fodder crops and coffee because they have practically no nutritive value. Figure 10 shows the distribution of the average production values

for developing states included this study. For hypothesis two to be supported, a *decrease* in the changes in production levels must be significantly correlated with an *increase* in food insecurity.

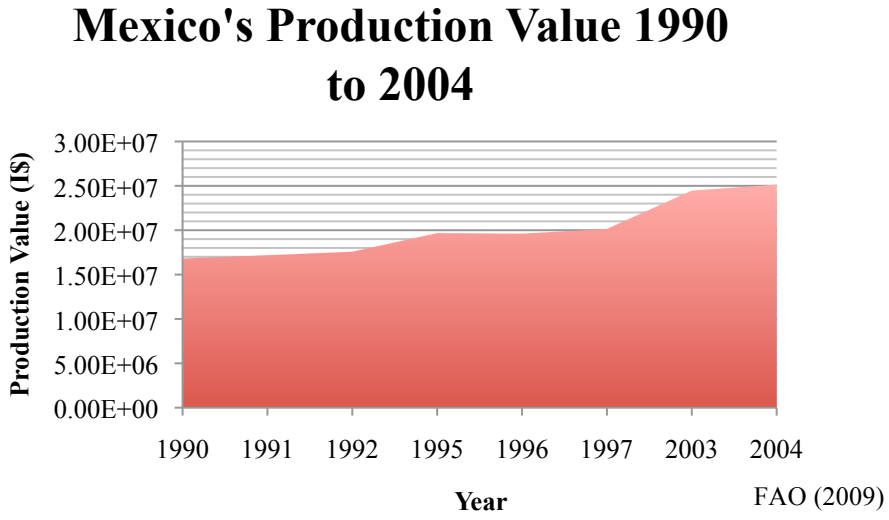
Figure 10



FAO (2009)

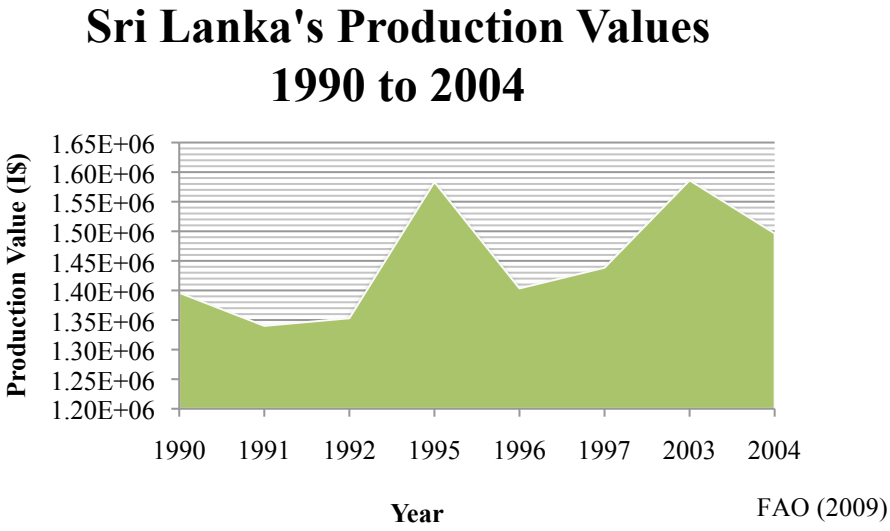
The three countries included in the puzzle have varying levels of production. Mexico's production value increased steadily from 1990 to 2004 (Figure 11). Sri Lanka, on the other hand, experienced periods of high and low production values throughout the period, undoubtedly due to the internal conflict between the Sri Lankan state and Tamil Tigers (Figure 12). Zambia experienced a period of low production levels following the 1992 drought but generally saw high production levels (Figure 13).

Figure 11



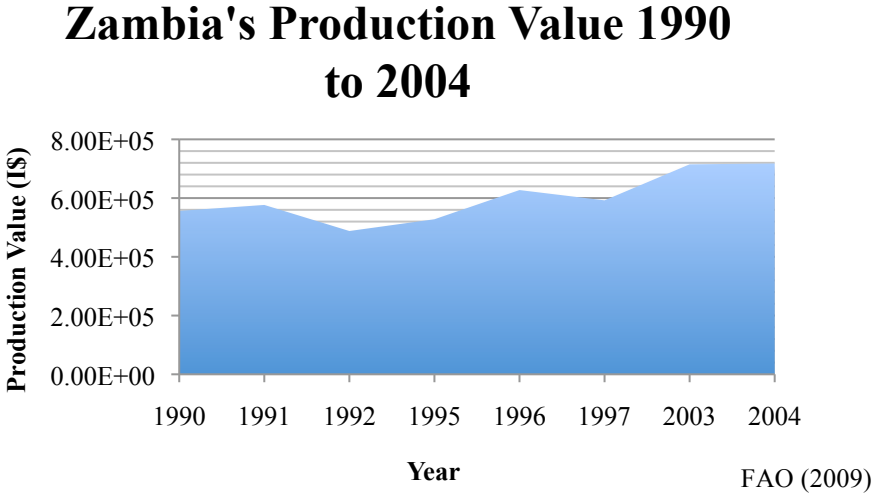
FAO (2009)

Figure 12



FAO (2009)

Figure 13



FAO (2009)

The Food and Agricultural Organization provides two related measurements to study changes in overall production levels for a state. The first measurement is gross production level, as mentioned above. The second measurement is gross production level per capita. Whereas the second measurement allows a clearer empirical comparison across states, the measurements for production levels in developing states may not be as reliable. Dividing claimed gross production by claimed per capita income might produce a measurement that is far from accurate. For this reasons, this model will include variables capturing both changes in gross production and changes in gross production per capita.

Control Variables: There are many factors that may explain food insecurity within a state. This model will also include conflict and natural disasters as control variables as well as access to clean water, access to improved sanitation, and regime type. Conflict and natural disasters will each be measured the same way in model two as they are in model one. In this model, however, the alternative hypothesis suggests that conflict matters most in explaining food insecurity levels. This may occur from low production levels or from situations in which those engaged in the conflict prevent the distribution of food to various or all sectors of the population. For this hypothesis to be supported, the *presence* of conflict must be significantly correlated with an *increase* in food insecurity.

As noted in the previous model, natural disasters may affect production levels, but they may also affect the distribution of agricultural products. If a natural disaster results in roads and infrastructure being damaged or destroyed, sectors of a population may not get access to food they need. The *presence* of natural disasters may be significantly correlated with an *increase* in food insecurity.

The next two control variables attempt to capture situations in which there is a lack of services and infrastructure in place to prevent widespread diseases from food contaminants that

may also result in increases in food insecurity. The third control variable in this model is access to clean water. To measure access to clean water, this research relies upon data from the World Health Organization's "Population with Sustainable Access to Clean Water, 1990 to 2006" (2009). This variable captures the percentage of the population and one representing greater than fifty percent of the population. If a state has *more than* fifty percent of the population with access to clean water this may significantly correlate with a *decrease* in food insecurity. Of the states included in this study, the minimum percentage of the population with access to clear water was thirteen percent and the maximum percentage of the population with access to clear water was ninety-seven percent. From 1990 to 2004 seventy-three percent of Mexico's population had access to clear water, seventy-two percent of Sri Lanka's population had access to clear water, and thirty-nine percent of Zambia's population had access to clear water.

The fourth control variable in this model is access to improved sanitation. The data used to measure this independent variable is from the World Health Organization's "Population with Sustainable Access to Improved Sanitation, 1990 to 2006" (2009). This variable captures the percentage of the population and one representing greater than fifty percent of the population. If a state has *more than* fifty percent of the population with access to improved sanitation this may significantly correlate with a *decrease* in food insecurity. Of the states included in this study, the minimum percentage of the population with access to improved sanitation was thirteen percent and the maximum percentage of the population with access to improved sanitation was ninety-seven percent. From 1990 to 2004 fifty-six percent of Mexico's population had access to improved sanitation, seventy-one percent of Sri Lanka's population had access to improved sanitation, and forty-two percent of Zambia's population had access to improved sanitation.

The final control variable for this model is regime type. It is possible that the more democratic a state is, the more likely the redistributive its policies will be. The Polity IV data

series (2008) is used to measure this variable. The variable is coded from negative ten to positive ten (calculated by subtracting the Correlates of War Polity IV score for autocracy from the Polity IV score for democracy). Of the states included in this study nineteen averaged a positive score (tending toward democratic) and eight averaged a negative score (tending toward autocratic). A *higher* score for regime type may significantly correlated with a *decrease* in food insecurity. This section has developed a research design to test the main and alternative hypotheses. The next section presents the findings of this study and discusses the implications.

Findings for Model Two

The findings for model two are listed in Table 7 (below). In model two, changes in gross production and changes in gross production per capita were both used as independent variables. As anticipated, both independent variables are in the predicted direction. Overall changes in gross production levels per capita, however, is the independent variable that is nearly significant (with a p-value of 0.011) controlling for natural disasters, conflict, access to water, access to improved sanitation and regime type. Substantively, these findings suggest that when production decreases by seven hundred international dollars per capita, the food insecurity level increases by one point holding all other variables constant. Table 8 (below) illustrates how changes in production values can affect Mexico, Sri Lanka and Zambia's expected food insecurity levels). As noted above, however, this measurement is not without complications.

Table 7: Model Two ~ Changes in Production Levels' Effects on Food Insecurity Levels

Explanatory Variable	Affects Changes in Gross Production on Food Insecurity Levels	Affects Changes in Gross Production per Capita on Food Insecurity Levels
Changes in Gross Production Level	-0.029 (0.731)	-------
Changes in Gross Production per Capita	-------	-0.70 (0.273)
Conflict	22.731 (8.454)	23.047 (7.51)
Access to Water	-0.884*** (0.170)	0.862*** (0.137)
Access to Improved Sanitation	-0.933*** (0.166)	-0.913*** (0.135)
Natural Disaster	0.039 (0.907)	0.403 (0.730)
Regime Type	0.951 (0.627)	0.803 (0.515)
Constant	332.172*** (15.423)	397.547*** (28.669)
Observations	170	240
R^2	0.24	0.27

Standard Errors are in parentheses.
Statistical significance is noted with ***p<0.001, ** p<0.005, * p<0.01.

Table 8: Predicted Food Insecurity Levels for Mexico, Sri Lanka, and Zambia

State	**Food Insecurity Level 2004**	**Expected Food Insecurity Level in 2014** With a Ten Thousand Dollar Decrease in Production Value per Capita per Year, holding all other variables constant at their means
Mexico	190	200
Sri Lanka	250	260
Zambia	330	340

FAO (2009)

Two of the control variables also are statistically significant. Access to clean water and access to improved sanitation are both highly statistically significant and the effects are in the predicted direction. Regime type, natural disasters, and conflict were not statistically significant. Both the presence of natural disasters and the presence of conflicts were positively correlated with food insecurity as predicted. Regime type is predicted to be negatively correlated with food insecurity (a *higher* score for regime type would correlate with a *decrease* in food insecurity) but the finding suggested a positive correlation. This may have important implications for the role of regime type in facilitating food distribution. Further study would need to include the role of food aid in decreasing food insecurity levels. It may be that autocratic states are more likely to receive food aid and this may mitigate the negative effects of a decrease in domestic production levels.

CHAPTER 6

CONCLUSIONS AND IMPLICATIONS

What explains food insecurity in developing states? The literature offers several explanations for food insecurity including: low production levels, natural disasters, and policies that discourage agricultural trade. This thesis argues that each of these explanations should be viewed through a political lens as policies chosen by a state may mitigate the effects of each. Further, this study contributes agricultural trade policies that discourage domestic production to the list of factors that may explain food insecurity. The quantitative study presented in this thesis systematically tests these explanations for food insecurity. Though the empirical findings fail to reach statistical significance, future research may serve to strengthen the argument that trade distortions policies that discourage domestic agricultural production help to explain outcomes of food insecurity.

The theoretical explanation for food insecurity presented in this thesis has been empirically tested between types of trade distortions and food insecurity outcomes. This relationship, though not shown to be statistically significant, may have implications both in the literature and for policy choices. This study argues as well as others argue that food insecurity is first and foremost a political issue. The neoliberal focus of the economic literature on food insecurity assumes that deregulating the market will allow a greater reduction of disparities in food insecurity. Deregulating or reregulating policies may increase income for exportable producers with a comparative advantage. Trade policies, however, that encourage imports may discourage domestic producers if those imports compete with their products. Thus it is essential that states take an active role in determining which products will be protected to ensure a domestically grown food supply.

This author recommends a set of policies for states with a pro-urban bias. These policies used together could benefit all three sectors of a given state's population and provided a greater assurance of food security. First, developing states should implement import taxes to discourage foreign food imports. This would provide an incentive for domestic producers to grow crops for domestic consumption. Import taxes have an added advantage of costing the state little to implement. Second, developing states should levy export taxes for goods that have a competitive advantage on the world market. Third, developing states should use the resources gained by levying export taxes to offset the increasing cost of food for domestic consumers.

There are a few examples of success stories from the developing state where some but not all of these policies were implemented. One such example is the emergence of "newly agricultural countries" (Friedmann 2002). Newly agricultural countries (NACs) are "semi-peripheral industrial-agricultural exporters who compete with the United States and Europe on increasingly liberalized agricultural markets" (McMichael 1995), 140). What NACs have done is choose to develop agricultural goods for export in which they have a competitive advantage. The example Friedmann uses is Brazil's investment in soy production. In the 1960s, Brazil was competing in the world market as an exporter of unprocessed soya to be used for livestock food. It used the export taxes on unprocessed soya to subsidize its urban manufacturing (including offsetting the cost of food for urban consumers working in factories). However, Brazil went one step further by investing in agro-industrial production by manufacturing value-added food commodities such as soymeal and tofu. Today, Brazil is the second largest soy exporter in the world (FAO 2009).

The example of Brazil highlights policy choices that rely on taxing the export producers and transferring those resources to keep consumer food prices low. However, these policies are

problematic if they are not implemented in tandem with policies that ensure production for domestic consumption. As Meera Nanda argues, the policies implemented in the NACs have created an "even deeper disarticulation of agriculture from the needs and lives of the local populations" (Nanda 2005, 20). That is, these policies have not addressed food insecurity within the population. For example, in 2004 Brazil was 220 kilocalories below the average minimum daily requirement (FAO 2009). The three strategies mentioned above must be used together to benefit the entire population. Doing so could result in a burgeoning export industry but, most importantly, can ensure food security for the entire population.

There are possible limitations to this policy recommendation that must be addressed. An import tax may discourage foreign producers from selling their products on the domestic market. Thus import taxes may not serve as an effective revenue source over time. This problem could potentially be solved if a state is able to industrialize quickly and/or has a strong comparative advantage in exportables that it may rely on via export taxes.

Going forward, research should test whether these policy recommendations may prove an effective option for pro-urban states experiencing food insecurity. Using case studies that focus on the agricultural policy choices of NACs, the research would particularly benefit discussing whether these states have chosen one or more of these policies and if these policies were successful in decreasing food insecurity levels for that state.

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Model One	Model Two
Bangladesh	Bangladesh
Brazil	Brazil
Chile	Chile
Cote d'Ivoire	Cote d'Ivoire
Dominican Republic	Dominican Republic
Ecuador	Ecuador
Egypt	Egypt
Ghana	Ghana
India	India
Indonesia	Indonesia
Kenya	Kenya
Madagascar	Madagascar
Malaysia	Malaysia
Mexico	Mexico
Nicaragua	Nicaragua
Nigeria	Nigeria
Pakistan	Pakistan
Philippines	Philippines
Senegal	Senegal
Sri Lanka	Sri Lanka
Sudan	Sudan
Thailand	Thailand
Turkey	Turkey
Uganda	Zambia
Vietnam	Zimbabwe
Zambia	
Zimbabwe	