THE POLITICAL DETERMINANTS OF AGRICULTURAL POLICY IN SUB-SAHARAN AFRICA

By

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ABSTRACT

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My thesis investigates the political determinants of agricultural policy in sub-Saharan Africa, but my work also has implications for broader questions of development economics and public policy formation. Agricultural producers are vital engines of economic development in this region of the African continent. For this reason, policies that enhance the stability and growth of agricultural production are among the most crucial to development more generally. Yet across much of sub-Saharan Africa, pricing policies often work to disadvantage agricultural production, while governmental spending on agricultural research and development remains low. Even more puzzling is the fact that rural constituents uniformly support incumbent policy makers at higher rates than their urban counterparts, even in the face of policies that are manifestly antithetical to their interests.

The answer to this puzzle lies in the importance of collective action to policy creation and change and, in particular, how institutional constraints and other such barriers to collective action shape representation in the agricultural sector. Utilizing both the cross-country and temporal variation in policy environments and outputs, I show that institutional contexts which facilitate collective action are associated with pro-agricultural policies, including lower taxes on agricultural products and higher national-level spending on agricultural R&D. Such contexts – which include institutional protections for civil liberties and higher levels of electoral competition – allow marginalized groups such as the rural poor to mobilize more effectively, which in turn result in policies more favorable to their interests. Such policies are further facilitated by sector-specific features and practices which enhance mobilization, typically by decreasing the associated costs of such actions. My findings underscore the importance of the broader political and institutional forms on agricultural policy. That is to say, my analysis demonstrates that prescriptions and suggestions for reforms that

are designed to enhance agricultural development should not and cannot be limited to those with agriculture as their sole and central focus.

This dissertation is dedicated to my late grandmother, Helen Lara: my role model, my kindred spirit. Gram, you know I love you more than my luggage.

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Of course, I would not be where I am today without the endless love and support from my mom, Deanean Lara. Many of my favorite memories with her involve the library or the bookstore where she was more than happy to encourage my insatiable reading habit. In grade school, my mom always urged me to choose strong, remarkable women for my assigned biography reports and I will always cherish the time we spent together researching women like Mother Theresa and Sandra Day O'Conner. She accommodated every single one of my requests to try new and intellectually stimulating activities. When I was 9 or 10 years old, this meant getting special permission to enroll me in an adult sign language class. This dissertation process has been particularly challenging and I've experienced countless moments of self-doubt; but with every one of my educational pursuits, my mom has not only had my back, she has lifted me up and carried me. When I was too busy to eat, she fed me. When I was overwhelmed, she would send me silly gifts and text messages just to make me laugh. She let me vent about all the minutiae of graduate school life even when she was experiencing her own difficulties.

I will never forget the time I went home to visit my mom and found a house completely devoid of blankets during the winter in Michigan. I was lucky to live within driving distance of her

house and I often stayed there throughout graduate school for various reasons. On this occasion, I discovered that all of the blankets in the house were gone, but my mom had forgotten this fact before I arrived. As was often the case, I got cold later in the evening and upon searching for a blanket, I could not find one. It turns out that my mom gave every single blanket in her four-bedroom home to her students and their families because the city of Detroit was cutting off the power to their homes. This is just one example from the very long list of examples of my mother's selflessness. Beyond that, she has a unique and exceptional capacity for empathy. She often feels and internalizes every feeling that I have, whether the feelings are good or bad. She has an uncanny ability to sense when I need her, even when I have not said a word. In high school, it was often the case that she could not watch my track meets because she internalized my nervousness and anxiety so deeply that it hurt for her to watch. Every one of my accomplishments, every moment of joy in my life has been felt by my mom, because my happiness is her happiness. She wanted me to complete this final hurdle more than anything, but not for her benefit; she wanted me to accomplish this for myself. She is so extraordinary in every way that I often feel like I do not deserve her. Mom, this dissertation will probably sit on a dusty library shelf for its entire existence, unread and without citation, which is perfectly fine by me. If nothing else, I want this dissertation to bring you joy and make you proud, because I owe this accomplishment to your immense sacrifices and endless support. I love you with all my heart.

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CHAPTER 1

INTRODUCTION

The countries south of the Sahara have seen many changes in the last few decades, none of which have been without challenges. Following decolonization, countries in the region have experienced national border changes, domestic and interstate conflict, political and economic regime transitions along with varying levels of economic development and industrialization. Despite the long list of changes since the early 1970's, agricultural sectors within the region have experienced an extraordinary level of stagnation. This particular status-quo bias in sub-Saharan Africa has been dubbed "urban bias" whereby governments have systematically chosen national policies that favor urban populations at the expense of rural ones. Some of those policies come in the form of price manipulations, whereby agricultural goods are kept at artificially low prices in order to satisfy the urban population's need for cheap food. Another pattern is in unequal taxation and spending levels across the urban and rural populations, with the latter supplying a larger share of the tax revenue which is then spent in urban areas.

During the 1970's, many countries in SSA used agricultural marketing boards to extract revenue from agriculture in order to fund industrialization efforts in the non-farm sectors of the economy. This pattern caught the attention of the World Bank and other international financial institutions who then began to require that countries meet certain conditions in order to qualify for financial assistance starting in the early 1980's. Most of the conditions were meant to decrease the size of the state and it's role in the economy. As countries began to accept these conditions, they decreased the state's role in distorting prices, but they also substantially reduced public spending on goods and services in rural areas. Public spending on goods and services in urban areas, on the other hand, was either unchanged or increased. This period of structural adjustment aimed to liberalize markets in a very drastic way, often at the expense of deliberate, country-specific needs. As states began to substantially retreat from their role in the market, institutional change did not keep up, which resulted in very weak and ineffective institutions and led to market failures as

countries struggled to compete internationally. Furthermore, the weak institutional environment allowed for the proliferation of rent-seeking behavior, which persisted even as countries democratized in the 1990's. The move toward more competitive and participatory systems created new incentives and opportunities for actors to engage in rent-seeking behavior through strong patronage networks. More often than not, the rural poor lacks access to these patronage networks; this further entrenches status quo policies that disadvantage the agricultural sector.

While the aforementioned pattern has been prevalent in much of sub-Saharan Africa, the degree to which this pattern is observed from one country to the next varies. For instance, Kenya represents an example of a policy environment that has been favorable to the agricultural sector compared to other countries in the region (Anderson and Bruckner 2012). On the other hand, there are more extreme examples of adverse policy environments in countries like Zambia and Madagascar where both pricing policies and spending allocations have put the agricultural sector at a disadvantage. Of course, some cross-country variation does not suggest that, in general, agriculture has *not*fared worse than other sectors. While revisiting the urban bias thesis, Gareth A. Jones and Stuart Corbridge (2010) point out that "there is little evidence to suggest that urban/rural welfare ratios are falling towards unity" (53). However, this variation is interesting given the similar timing of major economic and political changes in the region.

1.1 Motivation

What's more, a number of questions emerge from the following puzzle: within sub-Saharan Africa, government spending on agricultural research and development remains low, anti-agricultural pricing policies persist, and yet rural constituents tend to support incumbents more often than their urban counterparts. This puzzle in and of itself is cause for investigation. For one, it would be beneficial to revisit the urban bias thesis more generally by making use of new measures of governmental price distortions and expenditures within the agriculture sector. In doing so, I can address one of the issues brought up by Lipton (1993) in his reassessment of his own theory, which

has to do with the differences between the *types* of bias against farmers. One of those biases comes in the form of price distortions, which were the most widely discussed and observed throughout the 1970's and into the early 1990's. These were the types of biases that structural adjustment programs were intended to remove. The second type of bias comes in the form of government expenditure on public services and goods, which according to Lipton, has been concentrated more heavily in urban areas.

As Lipton (1993) notes, "it is essential to look at price and public expenditure components of UB jointly, so as to avoid misleading statements that overall UB has decline when it has merely changed is manifestation from price outcomes to expenditure outcomes" (248). While price distortions might be more obvious and recognizable to those who are selling the agricultural products, the distribution of public goods and public resources might not be as visible. Not only that, but not all price distortions will hurt the agricultural sector equally; some agricultural products will be hurt more than others depending on the distortionary policies the government chooses to undertake. Because of this, it might be the case that overall, the government is engaged in actions that distort prices, but they do not distort prices equally across products and therefore, the government can still maintain a higher level of support among the rural population in general. On the other hand, the net damage to rural populations is likely to be greater when expenditure bias increases because the goods and services will be distributed to particular areas, affecting all sectors in the area equally. Because the principal-agent problem is more likely in the distribution of public goods and services, it might be the case that governments can engage in this expenditure bias without suffering huge electoral losses.

While this area of research has been examined thoroughly by agricultural economists and policy analysts alike, political scientists have paid little to no attention to this area of study. To be fair, the topic itself has garnered more interest in recent years, but the "political" aspects warrant further investigation (Swinnen 2010). Agricultural economists mainly focus on agents, and specifically producers, consumers, and taxpayers, while largely ignoring political agents and variables (Swinnen 2010). As Rausser and Zusman argue, "to presume that governments have no role

or interest in this policy area would grossly misspecify explanatory models" (1992). Joseph E. Stiglitz, in his discussion of the theoretical aspects that inform agricultural policies, argued that governmental interventions have so often "incurred the economists' wrath" without giving much thought into incorporating political factors as something other than a headache unmeasured and contained in the error term (Stiglitz 1987, 53). More recently, there has been a concerted effort to combine theories across disciplines and to include political variables in the model specifications. Even so, the political factors are often either an afterthought by way of control variables or the measures themselves are poor and not up-to-date with the most recent developments in political science. Agricultural economists have recognized the need for different policy approaches that deliberately take institutions into account instead of relying solely on policies and models that focus on competitive markets. As a political scientist I believe that this topic is important for the field, mainly because no one has examined and tested the complex interaction between institutions, collective action, and identity politics with regard to agricultural policy within Africa (Swinnen 2010; Paarlberg 1999). (Swinnen 2010, Paarlberg 1999).

1.2 Why sub-Saharan Africa?

Governmental policies can both hinder and advance particular economic sectors depending on which route(s) the government decides to take. When it comes to the agricultural sector, countries in sub-Saharan Africa (SSA) have not experienced the same economic gains as those in Asian and South American countries in the last 30-40 years. Agriculture makes up a substantial portion of the region's GDP and employs over 60% of people in sub-Saharan Africa, most of whom remain employed in the agricultural sector out of necessity because of high unemployment rates across the region(*World Bank Development Indicators* 2012). An underdeveloped agricultural sector is often the major contributing factor behind food insecurity in Africa. Among the food insecure in Africa, over 50% come from farming households, the very people producing agricultural goods (Heidhues et al. 2004). Looking at just the countries included in this study, the number of people

employed in agriculture has stayed relatively stable between 1964 and 2004 according to estimates from the Food and Agriculture Organization found in table 1.1. South Africa and Nigeria are the only two countries observed in this study where agricultural employment is less than 50%, whereas Ethiopia, Mozambique and Tanzania have all maintained employment levels at 80% or higher.

Table 1.1 Employment (%) in Agriculture 1965-2004

Country	1965-69	1975-79	1985- 89	2000-04
Cameroon	86	77	71	58
Ethiopia	–	–	–	82
Ghana	61	61	60	56
Kenya	86	83	80	75
Madagascar	85	82	79	74
Mozambique	87	85	84	81
Nigeria	72	59	46	32
Senegal	83	81	78	73
South Africa	33	21	15	9
Tanzania	91	87	85	80
Uganda	91	88	85	79
Zambia	81	77	75	68
Zimbabwe	78	74	69	62

No data available for Cote d'Ivoire

– = no data available

As Lipton (1993) notes, the fiscal, administrative and environmental pressures "do not seem to have sufficed in most of Africa, despite the continent's exceptionally high degree of urban bias, and despite the fact that it is in Africa that the fiscal (and often environmental) unsustainability of urban bias seems clearest" (254). Because of the noted persistence of policies that are largely detrimental to the agricultural sector, there has been a call among those who study agriculture in sub-Saharan Africa to bring together agricultural policy research with social science and more specifically, political science, in order to fully analyze particular agricultural policies within the region (Hoeffler 2011). My dissertation attempts to bridge the various conversations and theories

into one analysis that utilizes data across time and space within the region. Using data that covers 14 sub-Saharan countries with observations for up to 48 years from 1961 - 2009, I disentangle the mechanisms that can explain the persistence of adverse agricultural policies.

1.3 Organization of Dissertation

This dissertation begins with a review of the relevant literature covering the determinants of policy change, but more specifically, those factors that affect agricultural policies in developing countries. The greatest difficulty in assessing these policies lies in the very nature of agricultural policy: it reaches across multiple policy areas and involves many players, both within and outside government itself, and involves national as well as international actors (Barling, Lang and Caraher 2003). Because of this, my literature review covers work from multiple disciplines and sub-disciplines including comparative politics, political economy, development economics, agricultural economics, and public policy. I use previous works to inform my own theories about what the underlying relationship is between the actors and institutions that commonly influence public policies. Furthermore, I mention areas that are lacking or missing in the explanations that exist presently and propose the ways in which my research will serve to fill in the pieces of a puzzle that has troubled both academics and policy analysts alike. Through this chapter, I hope to bridge some of the gaps that exist between the various disciplines that are searching for more generalizable explanations.

In chapter 3, I outline the various indicators and their associated measures, which are employed in the analyses found in chapters 4 and 5. The datasets are made up of secondary data from various sources and many of the independent variables are found in both chapters 4 and 5. The independent variables themselves fall into three broad categories: political institutions, collective action indicators, and structural features. The analyses in chapters 4 and 5 cover up to 14 countries within sub-Saharan Africa from 1961 - 2009 to test propositions about the factors that influence agricultural policies in this region of the developing world. Chapter 4 focuses on the government's role in designing policies that distort or change the prices that the agricultural sector receives for its

products. Then in chapter 5, I delve into the factors that impact the government's decision to direct tax revenues toward agricultural research and development. Chapter 6 concludes with a discussion of the contributions of this study to the overall body of work on agricultural policy, a summary of the results of my analyses, and my plans to expand on this work in the future.

CHAPTER 2

LITERATURE REVIEW

2.1 The Development Paradox and Urban Bias

What explains the patterns in agricultural policy in Africa? Why is it that governments with a large rural constituency are so opposed to policies that support the rural population? Why does a status quo bias persist in agricultural policy within Sub-Saharan Africa, where the status quo is anti-agriculture? The first major thesis that contributed to this research area was the urban bias argument, presented most notably by Michael Lipton (1977) and Robert H. Bates (1981). When looking at governmental policy priorities, the common pattern that emerged is one which has been dubbed the *development paradox*, where more developed countries protect their agricultural sector through particular policies, while developing countries enact policies that extract more from the agricultural sector. Lipton started with the focus on authoritarian regimes and more specifically, on the conflict between urban and rural interests, arguing that within developing countries, the government will protect urban interests at the expense of rural interests because the rural sector is economically and politically powerless (1977). Because urban dwellers have the capacity to overthrow regimes to a greater extent than their rural counterparts, authoritarian regimes in developing countries will favor urban interests to the detriment of the agricultural sector. As developing countries democratize, we should expect to see a shift toward policies that favor the agricultural sector, which constitutes a larger share of the population and hence, a larger voting pool. Bates and Block make this argument, noting that African countries with a large agricultural sector and more competitive party systems tend to produce more favorable policies for rural voters (2011). But this relationship is only present when the rural population share is very large (85% or more).

Robert Bates (1981) went a step further and explained this "powerlessness" as a collective action problem when trying to explain why, if politicians are rational, they make agricultural policy choices that are harmful to their citizens. During the time this book was written, governments in

Africa made many agricultural policies in favor of transitioning from a mostly agrarian economy to an industrialized one. In order to do this, they created monopsonies responsible for buying and selling agricultural goods. They were in charge of setting the prices, and often set prices so low that it hurt farmers. When it came to industry, they sheltered their domestic companies from international competition, which made the prices for those goods go up. This also hurt their citizens, because with low prices for their agricultural goods, they could not afford to buy the industrial goods that were overpriced. These policy choices simultaneously hurt agriculture and industry. These irrational policy choices needed to be explained, and Bates argued that the main reason political actors chose these policies was for their own political gain. Governments are made up of individuals who are interested in political power and are motivated to stay in power. Bates argues that poor agricultural development is not the result of irrational, inexperienced politicians, but is the result of a combination of rational decisions by rational actors. Governments are able to extract resources from agriculture through adverse pricing policies and can do so because of certain characteristics of the agricultural sector: it is very large and spread out, which makes it difficult for rural constituents to communicate with one another. This, in turn, makes collective action less likely among the rural poor.

Although the rural population supplies more votes, it is argued that collective action is less costly for urban dwellers, and therefore, they may more easily bring down the government by other means. Varshney (1995) also argues that democracies are less likely to tax farmers, but others such as Widner (1994) argue that democracy is not important, what is important is whether or not political elites have personal interests in agriculture. When elites own farms, taxes will be lower in the agricultural sector. Conversely, Robin Harding (2010) makes the argument that countries in SSA have actually moved toward *pro*-agricultural policies and bases this off an analysis of incumbent support among urban and rural populations. He finds that rural voters tend to support incumbents more often than urbanites and makes a substantial leap by then arguing this indicates that governments are catering to rural interests. Again, this is a substantial leap, given the data available on government interventions and their affect on the gross return to farmers. Still, his

work does produce a puzzle: if policies continue to disadvantage the agricultural sector, then why do rural voters support incumbents to a greater extent?

Analyses of survey data from the Afrobarometer show that rural voters in SSA tend to support incumbents more often than their urban counterparts (Harding 2010; Conroy-Krutz 2009). Work by Jeffrey Conroy-Krutz posits that incumbents utilize different electoral strategies among urban and rural voters with the latter receiving a higher proportion of "benefits" in return for their votes. Rural voters may be more prone to vote-buying strategies because they are easier to monitor and they are poorer than their urban counterparts, which makes them a cheaper option when incumbents are choosing to maximize their returns. Harding (2010) argues that rural voters support incumbents because incumbents enact policies that help rural voters while enacting policies that hurt urban voters. Because rural voters make up the majority of the electorate, incumbents will try to appease the rural majority to the detriment of urbanites by enacting policies that rural voters prefer. Harding uses an example from Stasavage (2005) who argues that Ugandan President Museveni used primary education spending as a tool to win over rural voters because rural voters prefer that a larger portion of the education budget is spent on primary education rather than secondary education, which urban voters prefer.

2.2 Political Institutions and Institutional Constraints

Amartya Sen argued in 1999 that famine had not occurred in a functioning democracy due to the presence of democratic institutions such as elections, opposition parties and a free press. At the time, Sen was correct in his assertion about the occurrence of famines in democracies, but the current situation tells a different story. Since 1999, many functioning democracies have experienced extreme food crises and even famine. The inability to provide even basic food security for their people should raise doubts about the effectiveness of those democratic institutions. If democratic institutions worked, we would expect that rural voters would become dissatisfied with the current government and prefer to vote them out.

The literature in the political economy and development fields have put forth various arguments to explain why African governments continue to implement policies that harm the largest sector of their economy. The institutional environment is an important determinant of policy choice. Douglass North, in explaining the variation in growth and development among different economies, argued that institutions are largely responsible for the persistence of poor performing economies (1990). Institutions are the rules or prescriptions that humans use for interaction; they govern human behavior in varying situations (Ostrom 2005). North argues that unproductive sectors of the economy persist because the "institutional constraints have provided the incentive structure for such activity" (North 1990, 110). In his view, the poor growth performance of the agricultural sector in Africa can be attributed to institutions, either formal or informal. Underdeveloped countries remain underdeveloped because they have failed to "get the institutions right." Reform in certain policy areas is constrained by the institutional environment; some institutional arrangements are more amenable to policy change. Policy change or stagnation will be the product of a myriad of intersecting political institutions. Much like the development paradox phenomenon, the status-quo bias phenomenon can be observed across sub-Saharan Africa in agricultural policy choice.

In the development field, dysfunctional political institutions have taken the blame for poor growth performance in Africa (Mkandawire and Soludo 1999; O'Connell and Ndulu 1999; Sandbrook 1986; van de Walle 2001). Weak democratic institutions have fostered the kind of neopatrimonial governance that panders to clientelism, corruption, and personalized political authority (Callaghy 1987; Jackson and Rosberg 1982). Strong democratic institutions hinder temptations for governments to engage in politically opportunistic behavior and instead encourage distribution of public goods on a wider scale (Alence 2004). Democratic institutions activate citizens to vote against policies that hurt them and therefore, democracies tend to have lower taxes than autocracies (Mulligan, Gil and i Martin 2004). Relatedly, Olper et al. (2014) find that among countries with large agricultural employment shares, when the regime changes from autocratic to democratic, the level of agricultural protectionism tends to increase. However, this is not the case for the African countries included in the analysis: this subset of countries did not show an increase in the level

of protectionism for the agricultural sector (Olper, Falkowski and Swinnen 2014). Acemoglu and Robinson (2012) argue that the key to poor development policies is in the institutions and more specifically whether or not the institutions are extractive or inclusive with the former involving a tendency to concentrate power among a small number of people.

Institutions constrain the ways in which actors interact with one another and hence, constrain how those actors organize around a common interest, which further explains why some policies are chosen over others. Where cooperation is necessary to secure favorable outcomes, the institutions in place will determine how costly that cooperation will be and therefore, which interests will prevail given the institutional constraints. Organizations perform better when institutions reduce the costs of cooperation: lowering transaction costs in information gathering, monitoring and enforcement (North and Weingast 1989; North 1990; Levy and Spiller 1996; Milgrom, North and Weingast 1990). But, as North argues, institutions are not necessarily chosen to maximize the benefits to society; instead, they "are created to serve the interests of those with the bargaining power to devise new rules" (North 1990, 16).

Policymaking does not occur in a vacuum, but rather it consists of an ongoing cooperation among the relevant players across time. Avinash Dixit extensively examined the transaction cost theory of politics and its role in the policymaking process. According to the transaction cost theory of politics, policy is "an equilibrium outcome of a political process, which is influenced by the costs of negotiating and implementing agreements" and also a function of the pre-existing institutions (Dixit 2003). In order for cooperation to exist among players, there must be some bargaining power or political exchanges that take place to facilitate cooperation. Whether or not players have access to bargaining powers is dependent on the institutional make-up of specific countries. Consequently, different institutional designs lead to very different transaction costs. Some institutional designs are built to facilitate cooperation with low transaction costs through institutional features such as checks and balances. On the other hand, some institutional designs hinder cooperation among players because the institutional constraints on exchanges have not been altered in order to facilitate a low transaction cost environment.

In the following sections on institutions, I will discuss the various formal and informal institutions that are cited often by other scholars whose research is concerned with governmental policy choice. Furthermore, they are the institutional features that I argue are instrumental in affecting the policy area of interest here: agricultural policy.

2.2.1 Formal Institutions: Veto Players

Institutions also affect the ways in which political actors interact and therefore, why some policies are chosen over others. In George Tsebelis' seminal work on policy actors, he argues that focusing on the main distinctions between political institutions can be reformulated to a focus on policy actors called veto players and their ideological distances from one another (Tsebelis 2002). Veto players are those individuals or collection of individuals that are required in order to make policy change. He further differentiates between institutional veto players and partisan veto players: institutional veto players are those players who are constitutionally defined to have specific powers in the policy process, whereas partisan veto players are defined by the political system itself. Within one regime, the number of partisan veto players may vary while the number of institutional veto players tends to stay constant. The underlying assumption of the veto players model is that players have circular indifference curves and within that curve the player is indifferent between alternatives that have the same distance from their preferred policy point on the curve, but will prefer any of those options in the circle to the status quo. The status quo is maintained when the number of veto players increases and/or the ideological distances between them increases, which suggests that policy change is the result of both the players' preferences and the institutions that determine who the players are.

The veto players model gets support among other scholars as well. Haggard and McCubbins (2001) find that as the amount of effective vetoes goes up, the players are less likely to come to a decision; these effective vetoes are referred to as "veto gates," which are institutions whose approval is necessary for policy change. Shugart and Haggard limit their model to only institutional veto players, which avoids the problem of identifying relevant partisan veto players. According

to Haggard and McCubbins, if there are many effective vetoes, then the policy environment will be one defined by resoluteness and less decisiveness. Resoluteness refers to the ability to sustain policies once a decision bas been made and decisiveness refers to the ability to reform policies. They further argue that as the number of effective vetoes increases, so too does the tendency to enact private regarding policies vs. public regarding policies. Cox and McCubbins define public regarding policies as the extent to which the policies resemble public goods, improve allocative efficiency, and promote the general welfare versus private regarding policies that funnel private benefits to individuals, factions or regions, in the form of projects, subsidies, and tax loopholes.

One limitation of the veto players model is that although a definition of veto players has been laid out, it is not always clear who makes up the entire population of veto players in any one country. There are institutional veto players, which are defined by the constitution, but partisan veto players are more difficult to discern and it may be difficult to distinguish actual veto players from other actors that have significant influence. This may be particularly true in areas that rely heavily on clientelism and patronage networks and those countries who have strong informal actors as well such as tribal leaders.

2.2.2 Formal Institutions: Electoral Systems and Political Competition

The choice of electoral system affects a variety of political dynamics including the incentive structure of policy actors and therefore, the policymaking environment. The incentives that actors face may be contingent on how candidate-centered or party-centered the electoral system is. Systems with a winner-take-all rule or plurality rule tend to be more candidate-centered in general because only one person can win any one seat. Consequently, candidates have an incentive to make themselves known to voters in a more personal way and this incentivizes more private-regarded policies. Conversely, proportional representation (PR) systems tend to incentivize more public-regarded policies because in order to win public office, the voters need to prefer a party, not a particular person so candidates do not need to claim credit for delivering particular goods at election time. Lizzeri and Persico's (2001) research shows that plurality systems tend to undersupply

public goods because they cannot be narrowly targeted to particular voters. Furthermore, Cox and McCubbins (2001) argue that candidate-centered electoral systems are more resolute and less decisive, so policy change should be more infrequent in countries that employ these types of electoral systems. In addition, Olper and Raimandi argue that within democratic countries, electoral institutions matter for agricultural protection: countries with proportional rules protect the agricultural sector more than those with majoritarian rules (Olper and Raimondi 2013).

There are a number of political economy studies devoted to establishing a link between political competition and public policies. Political competition is present when politicians must compete with one another for support from the public by way of votes during elections. Politicians use various strategies in order to achieve this, but among democratic countries in SSA, the strategies tend to be quite limited and rarely rely on programmatic or policy-based appeals (Poulton 2014). As Poulton (2014) notes, "it is common for senior representatives of a particular ethnic group to be included within a campaigning (and, ultimately, governing) coalition in order that they in turn 'bring in' the votes of people from their group or region" (S111). They may 'bring in votes' by targeting specific public goods to their regions (like research and development); by transferring specific goods to the region like subsidies (Bates 1981); or through the use of exchanges of patronage to individuals with networks of people whose votes they may influence (van de Walle 2007).

Focusing on the level of political competition in a country, Robert Bates finds that government policies are more anti-agriculture when the rural dwellers' population share is large, but this relationship is conditional on the competitiveness of the electoral system (Bates and Block 2011). If the electoral system is highly competitive, government policies will be more pro-agriculture in areas with a large rural population. Where the rural population is large, agricultural production tends to come from a large amount of small, highly dispersed farmers whose collective action is necessary to influence policy change, but the costs of organizing are high (Bates and Block 2009). Furthermore, Olper and Raimondi (2014) find that countries with proportional representation electoral systems tend to protect the agricultural sector more than those with majoritarian/plurality electoral systems.

2.2.3 Formal Institutions: Presidential vs. Parliamentary Systems

The legislative-executive relationship in a country sheds some light on the types of constraints that actors face when trying initiate policy change or make choices among a set of policy options. Gerring et al. (2009) touch on this relationship when looking at the policy outcomes inherent in different executive arrangements.

Work by Kim and Bahry (2008) goes into causal factors that influence presidential vulnerability in third-wave presidential regimes. Through a cross-national analysis of 52 emerging democracies (1974-2003), the authors establish various factors that contribute to the vulnerability of presidents. Looking more specifically at two regions that have experienced a large number of presidential interruptions the authors find that the main distinction in presidential vulnerability between Latin America and Africa is that the former regimes are more affected by anti-presidential demonstrations, while the latter are influenced by disproportionate presidential power. The authors argue that presidents in Africa face few constraints to their executive power and this is why we should expect their removal to be by force rather than through some other formal mechanism initiated by other branches of the government. If presidents across African countries are more likely to face threats of removal by force and are motivated by the presence of this threat, then they should be more responsive to groups more likely to participate in the overthrow: urbanites.

Presidential systems are also more prone to candidate-centered politics, mentioned above, and therefore, countries with presidential systems may be more likely to favor more narrowly targeted policies unless the executive anticipates a longer tenure in office. As Keefer (2004) explains "the less vulnerable such politicians are to expulsion by the other decision makers, the more that policy with reflect national rather than narrow interests" (15). In general, presidential systems seem to spend less than parliamentary systems, but various studies have failed to link regime type to the kind of governmental spending whether it be more nationally based spending or targeted spending (Persson and Tabellini 1999; Persson, Roland and Tabellini 2000).

2.2.4 Informal Institutions

Informal institutions are those constraints which are defined more by "codes of conduct, norms of behavior and conventions" (North 1990, 36). In studying and analyzing informal institutions in the comparative politics context, Helmke and Levitsky (2006) come up with the following definition of informal institutions: "socially shared rules, usually unwritten, that are created, communicated, and enforced outside of officially sanctioned channels" (1). Political actors will respond to a mix of formal and informal institutions and the relative weight of each will depend on the types of rules that are present in each country. Helmke and Levitsky (2006) further differentiate between certain types of informal institutions: complementary, accommodating, substitutive, and competing. In their analysis, they point out that developing countries tend to be characterized by substitutive and competing informal institutions rather than the former two categorizations. Competing informal institutions are those which are incompatible with the ineffective/weak formal institutions that are in place. They compete with the formal institutions because their goals are incompatible, usually because following one necessitates that individuals cannot follow the rules of the other type of institution. Substitutive informal institutions act in place of non-existent or ineffective formal institutions that would otherwise fill this particular role in society, so that their goals are still compatible. Examples of competing institutions are clientelism and patrimonialism and an example of a substitutive institution is the existence of traditional chiefs and chiefdoms.

Looking specifically at institutions in Africa, Michael Bratton defines informal institutions as the "patterns of patron-client relations" whereby political actors may exercise some power (2007, 97). These informal institutions provide different avenues for exercising power, especially in countries with relatively weak formal institutions (Helmke and Levitsky 2006). Furthermore, when formal institutions are particularly weak, people will rely more on informal institutions such as clientelistic networks (Bratton 2007). One line of argument posits that the patrimonial and neopatrimonial nature of politics that is prevelant within SSA started with the movement toward liberalizing the rural sector post-independence(Olukoshi 2005). Olukoshi argues that elites began to accumulate

more as arable land became privatized. Further, this period was characterized by a growth in state-corporations, monopolies, and agricultural marketing boards that gave patronage jobs to their family members and co-ethnic members and the distribution of agricultural inputs and services depended heavily on patron-client relationships (Hoeffler 2011). These post-independence patron-client relationships became institutionalized and have been very difficult to remove even as many countries in SSA have moved toward more democratic institutions and more liberalized markets.

Clientelism is upheld because it serves the interests of those that created it: political actors (patrons) (Bratton and van de Walle 1997; Bratton 2007). Within Africa, clientelism is a mutually beneficial practice. Because many of the formal institutions are lacking, politicians turn to clientelism as it can increase their perceived legitimacy. Patrons (politicians) provide resources to the clients (voters) in return for political support. The only way that clientelism will cease to exist, Bratton argues, is when clientelism is no longer seen as the most beneficial strategy (2007). If democratic elections are more institutionalized within society, politicians will have to turn away from clientelism at some point in order to get elected.

Since budgetary procedures in many countries either lack transparency or are discretionary, clientelism favors incumbents. Incumbents may be perceived as more credible on delivering goods because of their control over current government spending and incumbents have more access to the types of resources that are particularistic rather than distributive in nature. One such resource of particular importance to rural voters is fertilizer. Other researchers have pointed out the electoral benefits accrued to incumbents through the strategic use of fertilizer subsidies in Ghana, Tanzania, Malawi and Zambia (Banful 2011; Christiaensen and Pan 2012; Mason and Ricker-Gilbert 2013). In all of the aforementioned cases, fertilizer subsidies and/or input vouchers were targeted to supporters or to areas with opposition strongholds. These types of activities are tantamount to vote-buying, where the good (fertilizer in this example) is a tangible benefit to the voter. These examples also support the argument made by Conroy-Krutz (2009) about the tendency for incumbents to employ vote-buying strategies in rural areas.

More recent work by Kate Baldwin (2015) argues that traditional chiefs serve as substitutes for

more formalized representative institutions and shows that African chiefs improve representative governance in particular, for rural dwellers. Where there are weak formal institutions and in turn, weak provision of public goods, traditional chiefs may step-in and facilitate the delivery of more public goods. Traditional chiefs are considered an informal institution in that these "leaders are rulers who have power by virtue of their association with the customary mode of governing their communities" and are not chosen through more formal electoral mechanisms (Baldwin 2015, 6). Much like the reliance on ethnic group associations, voters may come to rely on more localized, informal channels to provide for public goods that are normally provided and distributed by the government. Strong clientelistic networks and a reliance on tribal leaders further blurs the lines of accountability from the decision makers to the voters. These particular examples of informal institutions work to substitute for other more traditional channels of public demand that traditionally force governments to be more responsive.

2.3 Group Dynamics

2.3.1 Principal-Agent Relationships and Governmental Responsiveness

In assessing the relationship that exists between voters and decision makers, Downs & Rocke (1994) conceive of this relationship as one with a principal and an agent where the voter is the principle and the chief executive is the agent. One can think of the politics and policy formation through the lens of this principal-agent relationship, which is inherently conflictual: each entity has an incentive to follow their own preferences. The principal's preference is for the agent to adhere to the public interest goals that they in turn 'principle', while the agent may be motivated by public interest or self-interest, and it is the job of the principle to monitor the agentÕs actions. Since the agent possesses informational advantages, there are costs that principles will incur when monitoring and enforcing compliance (Waterman and Meier 1998). For one, the players have imperfect information available to them on the issues that are relevant to them for policymaking, especially knowledge of the consequences of certain policy implementation. Players operate under

bounded rationality. Also, there are transaction costs that players will incur, such as the cost of implementation and enforcement. Furthermore, players may have the institutional hurdle of an inability to get a credible commitment between the principle and the agent. As Waterman and Meier note, most principle-agent relationships are not simple dyadic relationships; instead, agents are often constrained by multiple principles. Surely having multiple principals blurs the clarity of governmental responsibility for the average citizen. While the principle cannot usually effectively monitor the agent's actions, the principle can monitor the success or failure of the agent's decisions. Even if the action was done in the interest of the people, the principle must still punish the agent for the *outcome* or else future executives will be freed of this incentive effect. The constituency can control the agent (executive) by removing him/her from office at regular intervals. Weingast and Moran observe that "direct and continuous monitoring of inputs rather than of results is an inefficient mechanism by which the principle constrains the actions of his agent" (1983) and that both the principal and agent would be better off in a situation where the monitoring technology were improved.

Because parties are not strong in sub-Saharan Africa, it may do little good to pay attention to which institutions tend to produce more candidate-centered vs. party-centered strategies. Instead, one can focus on the extent to which voters have the ability to hold policymakers responsible; this will require that voters have enough information about performance given the electoral promises that were made by candidates. In a situation where information is widely available and governments are highly transparent, the voters might have an easier time monitoring policymakers. But in situations where information is scarce or not trustworthy, and the voters themselves have a hard time assessing the work of policymakers in office, the incentives for policymakers to make credible commitments will be diminished. Notably, Timothy Besley and Robin Burgess establish that a well-informed and politically active public will strengthen governmental accountability and responsiveness in their study of (2002).

2.3.2 Collective Action

The type of principal-agent relationship described above is typically characterized by collective action problems. Collective action problems are largely born out of inefficiencies in the coordination of strategies and behaviors among a large group of individuals. It is in the best interest of individuals to organize for their collective benefit, but it is the institutions that dictate how and if those individuals will organize at all (Olson 1965). Rural voters in Africa are less likely to organize due to the costs and constraints associated with collective bargaining (Bates 1981). Robert Paarlberg, when comparing Asia's experience to Africa, argues that Asia has been more successful in agricultural intensification because of its strong grassroots farmer organizations, which are largely lacking in Africa (1999).

Certain characteristics of the public good itself reveals a lot about the level of difficulty in collectively organizing to demand it. Probably the most telling characteristic is how susceptible the good is to the free-rider problem. Some public goods have characteristics that are more analogous to private goods in that they are excludable and are rivalrous, which makes them less susceptible to the free-rider problem. Goods that are more susceptible to the free-rider problem look more like pure public goods in that they are non-excludable and non-rivalrous, which means once the good is provided, it is very hard or impossible to exclude people from using it and using the good does not diminish the benefits/amount that is available to others. These characteristics are true even when individuals do not contribute to the groups' efforts to have the good produced, which describes the free-rider problem itself. Self-interested individuals who would like to see the good produced, may rationally conclude that if the good is going to be produced without their contribution, then the overall benefit to the free-riding individual will be greater because they did not incur any of the costs associated with ensuring its production. Assuming many or all individuals are rational, they will all reach this conclusion and the good will not be produced.

But individuals do collectively organize, so there must be some mechanism that mitigates or removes the free-rider problem. Work by Putnam et al. emphasizes the importance of civic com-

munities and social capital in predicting institutional performance in democratic countries and argue that democratic performance is enhanced through a strong civil society (Putnam, Leonardi and Nanetti 1993). A strong civil society is one in which there is active participation in public affairs where individuals can act collectively to demand better public goods and services. Other scholars argue that a strong civil society can overcome some of barriers to collective action and in particular, emphasize the role of trust and reciprocity in overcoming those barriers (Dahal and Adhikari 2008; Ostrom 2007). In Dahal and Adhikari's (2008) piece on bridging, linking and bonding social capital, they analyze the importance of each type of social capital and the presence of each in the Kalahan Education Foundation in the Philippines. Bonding social capital refers to the links between people who are similar to one another, bridging refers to connections between people who are not like one another, while linking social capital refers to connections with people in positions of power (Woolcock 2001). The combinations of these three types of social capital have an impact on the various types of outcomes that are observed when it comes to particular policies.

2.3.3 Organized Rural Interests (or Lack thereof)

The interest-group theory of government argues that public policies are the result of competition among interests to secure favorable outcomes. But what exactly influences which group(s) will win in the fight to make their policy preferences a reality? Groups that cannot overcome collective action problems will be least likely to secure favorable policies for their members. One barrier that groups may face is substantial competing interests. If there are a large number of competing interests, each group's influence over policy will be diminished, with smaller, unorganized interests experiencing more of the reduction in power. In countries where agriculture makes up a very large portion of employment, there is likely a substantial number of people that prefer policies that will help the agricultural sector, but with such a large group comes the possibility that policy demands will vary across the group as a whole.

Rural constituents tend to be spread out and numerous and lack the necessary infrastructure to communicate with one another. In SSA, the rural population tends to be more dispersed than

the urban population. This dispersion becomes more of a barrier to collective action when combined with inferior infrastructure for roads and communication. Where there are large numbers of individual farm holders, it will be difficult to organize around a common interest. This barrier may be mitigated by the increase of large-scale farms, who are better able to organize and make demands in their favor; as the number of large farms increases, the barriers to collective bargaining will decrease as large farms start to demand better prices and more favorable policies for agriculture. Robert Bates argued this in 1981, pointing out that farmers in Africa rarely participate in interest group politics. As the number of individuals employed in the agricultural sector decreases, the lobbying efforts by farmers should increase as the costs to collective bargaining decrease with the agricultural sectors' size (Olson 1965). Furthermore, Bratton (1999) shows that the poor and usually rural are more likely to demand change from informal channels and leaders, such as tribal leaders. As Bratton (1999) argues, democratic citizenship has not reached a large portion of the rural poor; voting seems to be the main venue for participation.

When analyzing the impact of collective action and organizations and their impact on governmental policies, it is important to point out the complexity inherent in collective action. As Vanni (2013) states, collective action is "very difficult to measure directly, also because its performance relates to institutional settings and social relationships and it may vary over time, cultures and communities." One such factor shown to influence a group's capacity to collectively organize is its level of asset specificity in the economy (Frieden 1991; Zahariadis 2001). Asset specificity refers to the extent to which assets can be used for another purpose outside of its original intended use. When asset specificity is high, it is very difficult to use the asset(s) for anything other than its original intended purpose. When the asset specificity is low, it is relatively easy to move asset(s) around for other purposes. When it is difficult to use particular assets for other purposes, it creates a situation in which the owner becomes somewhat stuck in a particular line of work or line of production. For this reason, there might be greater incentives to those involved in economic activities with highly specific assets to collectively organize to pressure governments for favorable policies in that area of the economy. In his cross-national analysis, Nikolaos Zahariadis (2001) found that in the face

of international competition, national economies with high asset specificity tended to have more governmental subsidies than those with low asset specificity. Alt et. al (1999) find that firms with a high degree of asset specificity tended to lobby the government for subsidies at higher rates than those with lower asset specificity in Norway.

Another factor that might mitigate the collective action problems faced by the rural sector in SSA is the frequency of interactions among individuals with similar economic interests. Repeated interactions are shown to increase trust, norms of reciprocity, and compliance among individuals, all of which help to overcome the free-rider problem (Ostrom 2007). Work by Dani Rodrik (1999) and William Easterly (2000), provide support for the idea that policies promoting economic growth are less likely in countries with weak social ties and weak, corrupt governments. While the poor often have some supply of bonding capital, they often lack strong ties by way of bridging or linking capital. Bridging capital is important, in particular in very diverse countries, because of it's capacity to mitigate conflicts between competing groups (Varshney 2000). Furthermore, without a sustained and relatively stable supply of linking social capital, it becomes very difficult for the poor to gain access to those responsible for the very policies they seek for their benefit (Woolcock 2001). As Poulton (2014) notes, all else equal, farmers from different regions may feel like they have less in common in terms of economic interests than the commonality they share with someone from their own ethnic group.

2.3.4 Ethnic Group Politics and Public Goods

Within the African context in particular, the main impetus for organization revolves around ethnic groups. Parties within Africa rarely distinguish themselves from other parties based on policy platforms; they instead tend to distinguish themselves based on *who* they represent and ethnicity tends to define that representation. This has persisted because it serves the interests of those vying for political power: making appeals based on ethnicity has proven to be more successful than making appeals based on policy platforms. Because people may easily move from one region to another, from one class to another, or from a rural to urban job, they can easily change loyalties

based on these factors. As Dowd and Driessen argue, when ethnicity and race "are politicized and that politicization is institutionalized in the party system, the political landscape becomes frozen along the ethnic dimension" (2008, 3). The dominance of religious and ethnic parties diminishes the incidence of agriculture-oriented parties or candidates, which will negate any possible effect of left, right or centrist leaning governments. And as Kimenyi (1998) argues, "even when coalition parties emerge, they are soon dominated by one ethnic group" (326). Ethnic groups in SSA act like powerful interest groups in that they organize interests around a commonality among the group: ethnicity. Furthermore, ethnic groups are an important institutional characteristic that may impact the sorts of policies that are undertaken and implemented in particular countries (Horrowitz 1985; Kimenyi 2003).

In her analysis of ethnic party success in India, Chandra (2003) establishes that patronage-democracies are ones in which ethnic parties and ethnic voting will be most prevalent. Under this system of democracy, the state has a monopoly over the source of jobs and services and elected officials have considerable discretion over the distribution of resources. Within this context, she first assumes that ethnic voters and elites are strategic actors in that they seek to maximize their utility, where utility is broadly defined to mean any desired benefit, economic or otherwise. Furthermore, these utility-maximizing voters face extreme informational constraints and in the face of these constraints, they will look to co-ethnics for the distribution of benefits. People with minimal skills and lower levels of income are most dependent on the patronage of the state and have few options outside of the system to supply particular goods. Secondly, she argues that ethnic voters will continue to support co-ethnic parties even when they do not see any benefit after the election. This particular point helps to explain the persistence of incumbent support among rural voters in SSA: in the face of informational constraints, the clarity of responsibility will be low, which makes it more difficult for voters to make electoral decisions based on past performance. Therefore, voters may be more inclined to use ethnic group cues to make their electoral decisions.

Dixit (2003) takes these points further and reflects on a problem that is often related to countries made up of a heterogenous collection of ethnic and tribal groups: the common agency problem.

One can think of the politics through the lens of the principal and agent and the relationship that exists between the two entities, which is inherently conflictual: each entity has an inclination to follow their own preferences. The principal's preference is for the agent to adhere to the public interest goals that they in turn 'principle', while the agent may be motivated by public interest or self-interest, and it is the job of the principle to monitor the agent's actions. Since the agent possesses informational advantages, there are costs that principles will incur when monitoring and enforcing compliance (Waterman and Meier 1998). For one, the players have imperfect information available to them on the issues that are relevant to them for policymaking, especially knowledge of the consequences of certain policy implementation. Players operate under bounded rationality. Also, there are transaction costs that players will incur, such as the cost of implementation and enforcement. Furthermore, players may have the institutional hurdle of an inability to get a credible commitment between the principle and the agent. As Waterman and Meier note, most principle-agent relationships are not simple dyadic relationships; instead, agents are often constrained by multiple principles. Surely having multiple principals blurs the clarity of governmental responsibility for the average citizen.

Not only are ethnic groups influential in organizing political parties, so too are they influential in the organization of their members' interests. Countries where ethnicity is highly politicized tend to be associated with lower development, usually from weak public goods provision and policies targeted toward narrow benefits (Easterly and Levine 1997; Keefer and Vlaicu 2008; Posner 2004). According to Dowd and Driessen, voters who are located in countries with ethnically dominated parties believe they have little choice but to vote along ethnic lines (2008). Candidates know that ethnicity is a driving force for many voters; voters tend to support co-ethnics, therefore, candidates do not have to expend as many resources to secure votes from co-ethnics (Chandra 2004). Ethnic groups tend to be concentrated in certain geographical areas and so too, is the production of crops. With that being said, research has shown that farmers who are located in the governing party's home face higher taxes on their crops than those outside of it (Kasara 2007). One conclusion to be made of this finding is that voters are more likely to vote for co-ethnics, regardless of the

negative effects they face with higher tax rates. This points to the difficulty that many farmers face in bargaining for their interests. If they have no other alternative than to vote for co-ethnic candidates, there is no incentive to overcome the costs of collective action and secure policies in their favor. Furthermore, Mwangi S. Kimenyi points out that "a tax on a particular agricultural commodity is often a tax on a particular ethnic group" (1998, 326). If policies are the result of competing interests, then in the African context, policies will be the result of competition among ethnic groups. If one or very few ethnic groups tend to dominate the political realm, then there is very little competition over possible policy options: the choice will largely be made by the dominant ethnic group(s). If those dominant groups have little interest in policies that support the agricultural sector, the collective action problems associated with the rural population look more and more dire.

Countries within sub-Saharan Africa have a high degree of ethnic heterogeneity and furthermore, ethnicity is very salient. Belonging to an ethnic group is considered somewhat permanent in that membership is static: it is difficult for non-members to become members and vice versa. Not only that, but the groups solidify their "permanent-ness" through their repeated interactions with one another. Ethnic groups in SSA tend to stay geographically close to one another and have the kinds of repeated interactions that builds trust within their respective groups that they may not possess for "outsiders." Also, if there is a foreseeable future to the interaction between players this enhances credibility: past behavior by players and enforcement mechanisms are good determinants of whether or not players will stick to their commitments. In the context of agriculture, this preference for interactions within one's own ethnic group might undermine the group's ability to organize collectively around their shared interest to secure policies in their favor. They may still reap the benefits of their ethnic membership if co-ethnics have access to at least some political power because the ethnic group can act much like an interest group would in securing benefits for its members. When there are very few groups in power, they have an incentive to distribute more benefits, including public goods, to members of their own group at the expense of those groups who do not have power. Conversely, as more groups obtain access to governmental power, the

more they may have to cooperate with one another for their mutual benefit (Kimenyi 2003). In this sense, some of the constraints that farmers face when trying to organize in their interests might be mitigated by a more equal distribution of power in government: as more ethnic groups have access to political power, farmers should see an increase in pro-agricultural policies that spread benefits across multiple ethnic groups. On the other hand, fewer ethnic groups in power might result in a more targeted distribution of benefits that may not include a large portion of the agricultural sector if those ethnic groups do not have a large number of members who are rural and employed in agriculture.

Another way that ethnicity affects policy outcomes is outlined by Alesina et al (1999) when they argue that ethnic groups might have different preferences when it comes to public goods. Relatedly, this impacts the preferences that individuals have on the levels of taxation: when a large portion of the population has preferences that are quite different from what is actually provided by way of public goods provision, individuals might prefer to pay less in taxes than see their tax dollars spent on public goods that they do not want. According to Alesina et al (1999), this might be more likely when ethnic groups have very different preferences for public goods. They argue further that "the identity of the beneficiaries of the public good directly influences the utility level of each individual" (Alesina et all 1999, 1253). This means that if one individual perceives or believes that a public good is benefitting a particular ethnic group that they are not a part of, they may be less likely to prefer that public good or to contribute their tax dollars to the provision of that public good.

2.4 Persistant Agricultural Bias

Referring back to an earlier point in my discussion of the tendency for rural voters to support incumbents, I argue that Robin Harding's (2010) explanation is incomplete. Although Harding's (2010) findings do suggest that rural voters will support incumbents more often than urban voters, he is missing a large piece of the puzzle. First, the author assumes that rural voters prefer primary

education spending over all other policy choices. Even if rural voters are more likely than urban voters to prefer primary education spending over secondary education spending, this says nothing of the relative impact of these preferences. It might be the case that within education spending, a rural voter might prefer primary education spending over secondary education spending, but *overall* that voter might prefer that more tax revenues get funneled into policies that more directly impact farmers. If election outcomes are the result of "pro-rural" policies, then how can we explain the distortionary policies enacted in the very policy area that directly affects rural voters: agricultural policy? I argue that incumbents see a wide range of possibilities in distortionary policies that may influence voters and choose a combination of policies that will appease as many people as possible, which also includes urban voters. Incumbents do not "ignore urban voters" as Harding argues, but instead, they appease rural voters with distortionary policies in other policy areas that do not directly affect their household income: education. Agricultural policies are still widely distortionary to the detriment of rural voters: they are distorted to keep food prices low, which urban voters prefer. This, in combination with increased primary school spending, works to appease both urban and rural voters ensuring a larger vote share for incumbents overall.

Furthermore, we can compare rural and urban voters using the same Afrobarometer survey data that Harding uses for this analysis and look at what they deem to be the most important problem facing their country. Looking at figures 2.1, 2.2, and 2.3, we can see how these two groups compare in their response to the question: In your opinion, what are the most important problems facing this country that the government should address? The respondents were to choose their top three priorities. The figures are dot plots of the relative importance of each problem for each group: rural and urban. The responses are ordered by frequency of response for rural votes and the arrows show how much rural and urban respondents differed in their response rates for that particular problem. Arrows that point to the right show that the rural respondents chose that option at a higher rate, while arrows that point to the left show that urban respondents chose that option at a higher rate.

With respect to each groups' prioritization of education, urban and rural respondents are nearly identical in their preference for education as a governmental priority across all three figures. Fur-

thermore, starting with the most important problem in 2.1, if you look at categories that would more directly impact rural voters, the responses are clear: rural respondents believed that the priority should lie in fixing problems related to food shortage/famine, farming & agriculture, and the water supply over fixing problems related to education. In 2.2, we see almost the same pattern with regard to their second priority except that those who responded with farming/agriculture were almost equal with those that responded with education. Lastly, in 2.3 we see that only water supply remains close to preferences for education, which suggests that education was not a primary concern for rural respondents across their first, second, or third preference.

The preference patterns that emerge from these figures fit directly with one of the major theses of the urban bias camp: governments keep food prices low to offset some of the economic burdens faced by the urban poor. The reason that I say this is because of the frequency with which urban respondents choose problems related to poverty and unemployment; for example, 2.1 shows that over half of the urban respondents chose problems associated with the economy such as unemployment and wages. In comparison, rural respondents chose problems associated with the economy at a rate of 37.6% and chose agriculture and farming related problems at a rate of 33.9%. The patter is similar in 2.2 and 2.3: urban respondents chose problems associated with the economy at a rate of 29.37% and 17.82% respectively. Rural voters chose agriculture related problems for their second and third choices at rates of 32.4% and 23.4% respectively compared to economic related problems at a rate of 21.1% and 14.5%.

It is not surprising that both urban and rural voters worry about their economic well-being with respect to unemployment and the wages they are paid, but rural respondents are more consistently worried about food shortages compared to urban respondents particularly in their first and second responses. While I cannot say for sure whether or not urban bias is the reason for these differences, it does seem to suggest that if the urban bias literature is correct and governments in SSA respond to urban voters' preferences at a higher rate, then one could assume that if urban voters are mostly concerned about issues such as unemployment and poverty, then governments will respond by lowering food prices, which hurts the rural sector.

Figure 2.1 Most Important Problem

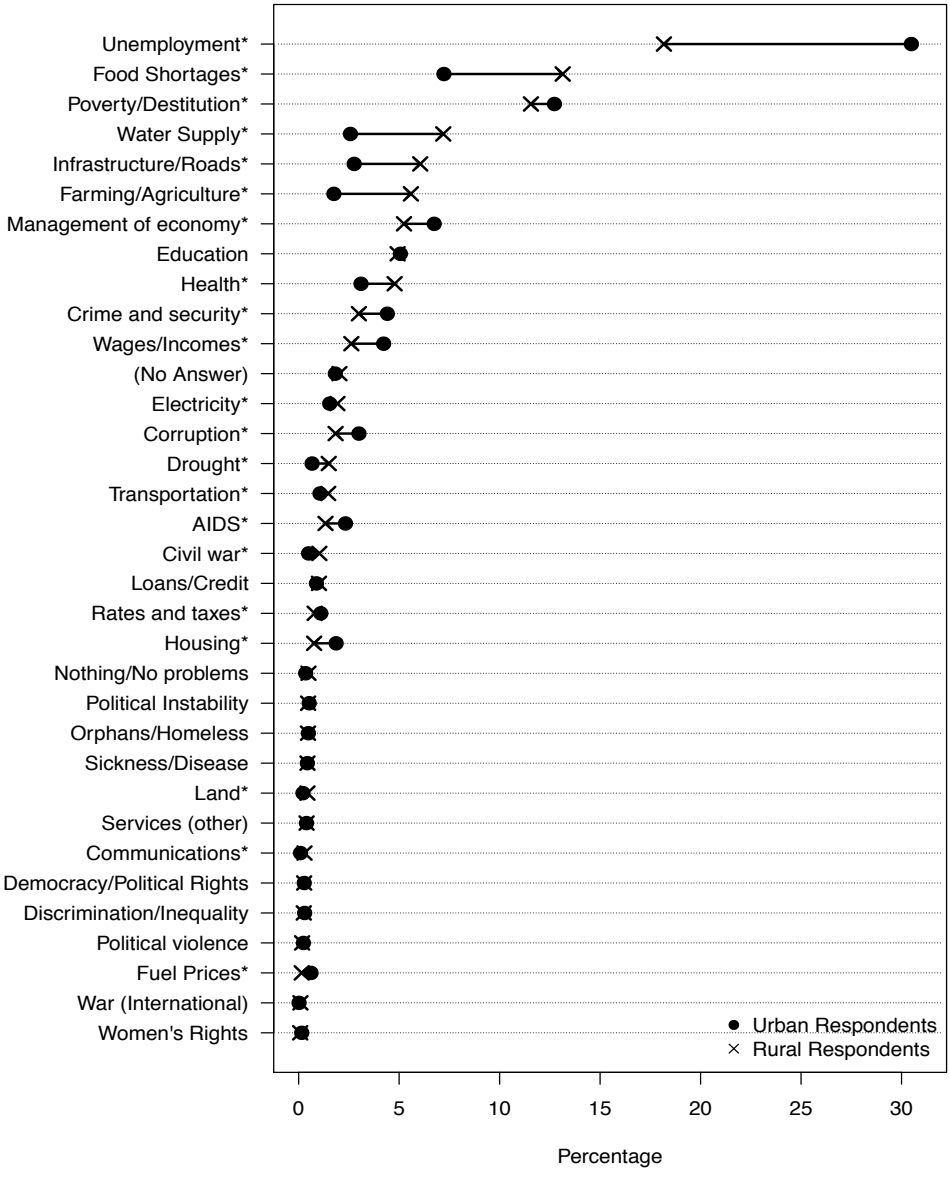


Figure 2.2 Second Most Important Problem

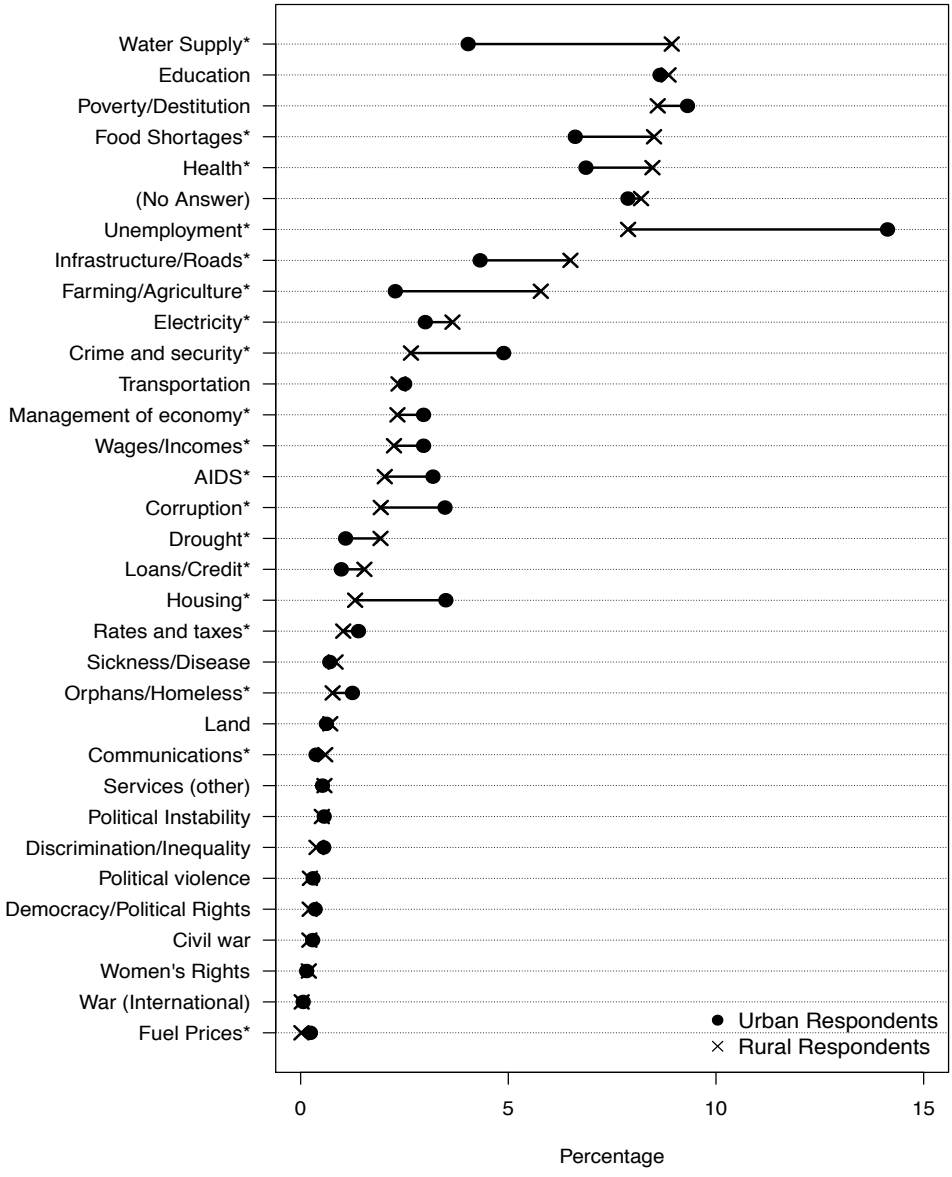
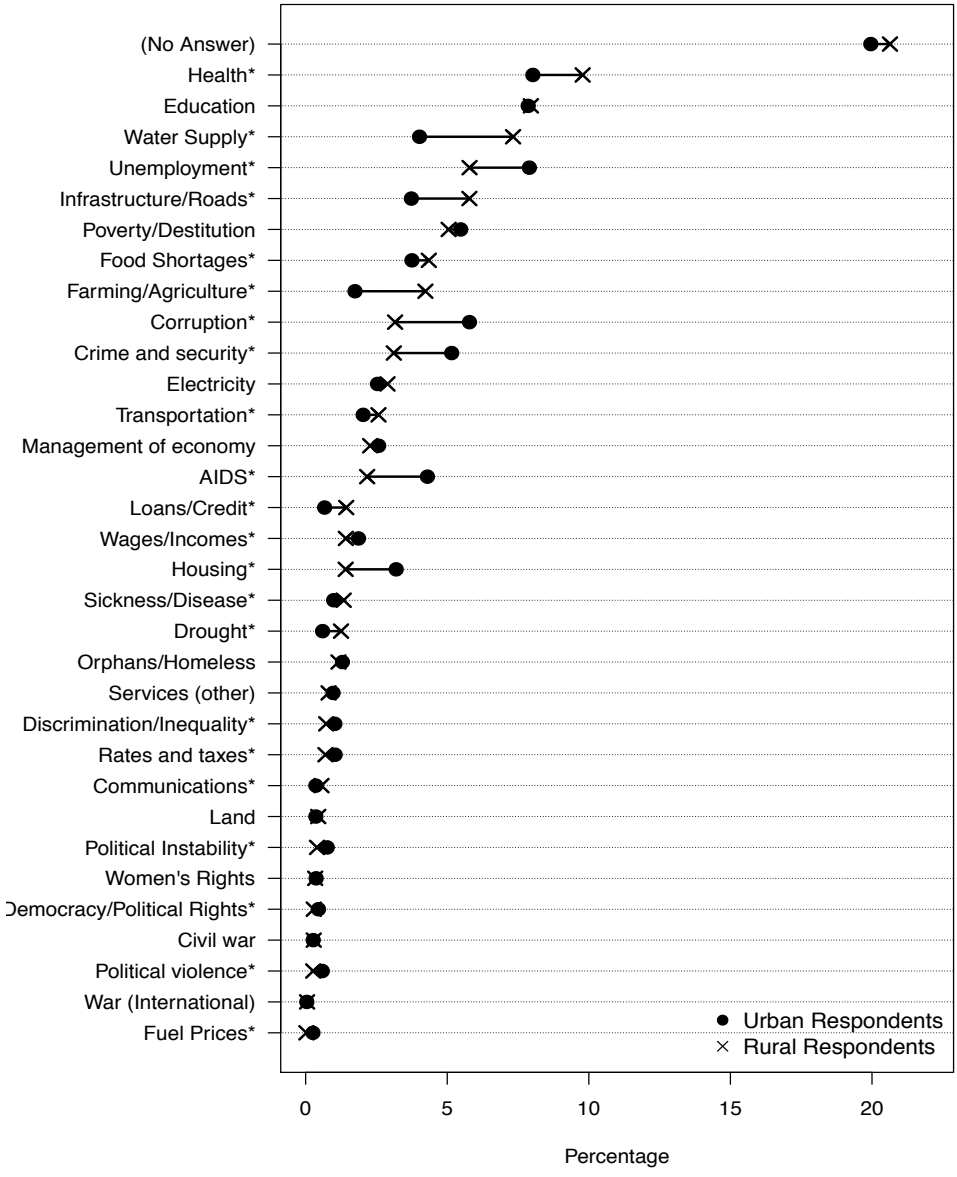


Figure 2.3 Third Most Important Problem



2.5 Conclusion

Throughout this chapter, I have identified and summarized the various theories, spanning multiple disciplines, in order to come up with a unifying theory to explain agricultural policy choice in sub-Saharan Africa. To summarize, countries in SSA tend to be characterized by heterogeneous populations with various ethnic, language, and religious differences and this is true of the rural sector as well. Not only that, but unlike the urban sector, the rural sector tends to geographically dispersed rather than geographically concentrated. Both of these characteristics make it less likely that the rural poor will extend their social linkages beyond those that are characterized by bonding social capital (like ethnicity) and into those social ties that are characterized by bridging and linking social capital (like employment or political party affiliation). Because of this, the rural sector is unlikely to collectively organize around their shared policy preferences and therefore, agricultural policy in SSA will not reflect what is in the best interest of those it attempts to directly impact.

Furthermore, certain institutional designs might mitigate some of the collective action barriers that the rural sector faces, but it will depend on the policies in question. The kinds of institutions that might produce more agricultural subsidies, for instance, might be the exact institutions that tend to be associated with less spending on a public good like agricultural research and development. Political institutions shape the policy environment that policy actors find themselves in and are important to understand when parsing out the political determinants of particular policy choices. What follows is a discussion of the indicators and measures that will be used in the operationalization of many of the factors I discussed throughout this chapter, which largely fall into the following categories: collective action indicators and political institutions.

CHAPTER 3

DATA AND METHODS

3.1 Introduction

As previous research suggests, there are a myriad of intersecting factors that influence public policies. Research in political economy has focused on institutional factors, which define and shape the interaction between various actors. Furthermore, research in political economy of development and agricultural economics focuses on the opportunities (or lack thereof) for collective action among those who have a vested interest in particular policy outcomes. The set of factors that influence collective action are often difficult to operationalize and measure, especially in the context of SSA. This chapter will focus on the subsets of variables that, according to my theories, affect the agricultural policy outcomes in various countries. The first section will focus on measures of the main explanatory variables which consist of political institutions and those that I call "collective action capabilities." The second section will focus on secondary explanatory variables which largely measure the extent to which a country is inclusive or extractive. Lastly, I will discuss the inclusion and measurement of various control variables. Because the independent variables are largely consistent across both of my analysis chapters, I will not discuss the specific hypotheses until chapters 4 and 5, which deal with determinants of agricultural pricing policy and agricultural R&D spending respectively.

3.2 Main Explanatory Variables: Formal Institutions

3.2.1 Electoral Competition

Various institutions and combinations of institutions are linked to policies that either help or hinder development. One such feature is the degree of electoral competitiveness that results from a combination of institutions. Rural constituents make up the majority of voters and laborers in SSA. In

a political environment where political actors rely on votes, the expectation is that the larger the numbers, the greater the share of benefits to those particular groups. This has not been the case in SSA and one such factor to explain why is the level of electoral competition. When political actors are faced with minimal electoral competition, they have little incentive to build support based on their ability to make credible commitments to certain policies. If the political landscape moves toward more political competition, the incentives to build support among greater numbers of voters increases and in the case of SSA, the greatest numbers are found among rural voters. Furthermore, many parties across SSA are weak and may not last longer than a few election cycles, thereby severing the potential long-term link between citizens and political party, further driving down the incentive to make credible policy commitments.

There are various ways in which electoral competition is commonly operationalized and measured. In order to be thorough, I include two different measures of electoral competition. The first indicator of electoral competition (called institutionalized political competition by the authors) comes from the Polity IV dataset (Marshall and Jaggers 2002). I prefer this indicator for one major reason and that lies in the operationalization of the indicator. When considering electoral competition and it's effect on policy outcomes, it is important to note that competition between parties based on specific policy platforms is relatively rare in countries within sub-Saharan Africa. Instead, many parties in sub-Saharan Africa are ethnically based and in many cases build relationships with citizens through clientelistic means. This particular indicator of electoral competition specifically addresses ethnic based parties and how the existence or prevalence of ethnic based parties may seriously undermine competition for power.

The variable itself is a composite variable that combines scores on two other variables in the Polity IV dataset: the regulation of participation (PARREG) and the competitiveness of participation (PARCOMP). Each of these variables is described below with the final composite score and its components listed in Table 3.1.

First, the competitiveness of participation variable measures the extent to which there are limits or specific rules on how political preferences are expressed. Each observation can take on a value

from 1 to 5 with the following categories:

1. Unregulated: there are really no binding rules or limits on political activities and political groupings form based on something like ethnic or religious groups, regions, etc., but the participation is fluid and varies over time.

2. Multiple identity: the political groups which form are somewhat stable but occur across various types of groupings like parties, regional groups , ethnic groups, but their preferences do not overlap, so there is no single dimension that tends to organize political activity at the national level.

3. Sectarian: political demands are characterized by incompatible interests and intransigent posturing among multiple identity groups and osccillate more or less regularly between intense factionalism and government favoritism" (Marshall and Jaggers 25, 2007).

4. Restricted: political participation is somewhat organized but significant groups are left out of the process.

5. Regulated: there are stable political groups that endure and compete for political power without coercion and without excluding significant groups the process.

The second variable, Regulation of Political Participation, ranges from 0 to 5 and measures the extent to which there exist other competitive choices outside of the ruling regime. A score of 0 indicates that the country was not coded for competitiveness because it either received a score of 1 on the PARREG variable or is a country in transition from a score of 1 to other regulated forms of participation.

1. Competition is repressed and opposition groups are strictly prohibited; typically countries that fall into this category are authoritarian in nature, but it is not a necessary condition.

2. Countries *suppress* competition, but it is not banned outright. If 20% or more of the adult population are consistently excluded from the political process, then that country is considered to have suppressed competition.

3. Factional competition where religious or ethnic-based parties consistently vie for political power to advance the interests of their own group to the detriment of other groups.

4. Transitional cases are basically factional cases that are making serious strides to move toward a more competitive system.

5. Encompasses those cases that are considered competitive whereby secular groups consistently and regularly compete with one another without the existence of any coercion.

Taking these two variables together (PARREG and PARCOMP), the authors come up with an index of political competition (POLCOMP). The variable ranges in values from 1 (least competitive) to 10 (most competitive):

Table 3.1 Coding Scheme for Polity IV Political Competition (POLCOMP)

POLCOMP	PARREG	PARCOMP
(1) Suppressed	Restricted (4)	Repressed (1)
(2) Restricted	Restricted (4)	Suppressed (2)
(3) Imposed transition: loosening or tightening restrictions	Sectarian (3)	Suppressed (2)
(4) Uninstitutionalized	Unregulated (1)	Not applicable (0)
(5) Gradual transition from uninstitutionalized	Multiple Identity(2)	Not applicable (0)
(6) Factional/Restricted	Sectarian (3)	Factional (3)
(7) Factional	Multiple Identity (2)	Factional (3)
(8) Persistent conflict and coercion	Sectarian (3)	Transitional (4)
(9) Limited conflict and coercion	Multiple identity (2)	Transitional (4)
(10) Institutionalized electoral	Regulated (5)	Competitive (5)

The second competitiveness indicator, the Executive Index of Electoral Competitiveness (EIEC), comes from the Database for Political Institutions (Beck et al. 2001). It is a measure of the competitiveness of the executive selection process and consists of 7 levels, which are provided below. Following the logic of Bates and Block, only those cases that receive a score of 6 or 7 are considered "competitive" and coded as 1, while all other scores are coded as 0 or "non-competitive."

1. No executive exists
2. Unelected executive
3. Executive is elected, but was the only candidate
4. Executive is elected, and there are multiple candidates (from same party)
5. Multiple parties are legal and therefore, candidates from other parties can contest the election
6. Multiple candidates from different parties competed, but executive won more than 75% of the vote
7. Multiple candidates from different parties competed and the executive won less than 75% of the vote.

3.2.2 Electoral Systems

The second institutional variable considered is that of the choice of electoral system. In democratic countries with regular elections, we think of candidates as representatives of the interests of voters. The electoral system in any one country produce tells us the way in which votes are distributed to candidates. If we assume that candidates are self-interested and run for office in order to win that elected office, then the rules that dictate how votes are distributed to candidates will likely affect their electoral strategy. In winner-take-all systems (also called pluralities), the candidate with the most votes wins that particular elected office; a candidate does not need a majority of votes, just a plurality, or enough to beat all other candidates running for office. If that is the goal, then the

electoral strategy must be one that seems to guarantee the largest number of votes overall and one strategy that tends to be associated with winner-take-all systems is the adoption of platforms that are more general and less specific. In other words, winner-take-all systems do not produce great incentives to stake out a particular policy stance or stances that may benefit specific groups at the expense of other groups.

Conversely, proportional systems incentivize a different kind of electoral strategy because the goal is not to get the most votes but to get *enough* votes to win office. What exactly "enough votes" means will vary, but candidates can target a specific group or groups of voters if they believe that target will be enough to win them office. Therefore, their policy platforms can be more specific and geared toward more narrow groups. There are some systems that incorporate somewhat of a "mixed system" where a winner-take-all and proportional rule exist for electing a candidate.

A further point to be made about proportional vs winner-take-all systems is that in the former, we tend to observe more parties than in the latter. With more parties might also come an increase in electoral competition, which I hypothesize will result in favorable policies for agriculture.

Three dummy variables are created indicating whether the country used a proportional, winner-take-all, or mixed system within a particular year. A value of "1" indicates that the country that particular system in place while a "0" notes the absence of such a system. In all, three countries had a proportional system and one of those three countries has used a proportional system exclusively. Four countries have at some point used a mixed system and two of those have used a mixed system exclusively. And finally, the most common system used is the winner-take-all system, which has been used by twelve countries and of those twelve, nine have used this system exclusively throughout the time period measured.

3.3 Main Explanatory Variables: Collective Action Capabilities

Following along with my overall theory, I make the general statement with regard to collective action: when barriers to collective action decline within a country, public support to agriculture

will increase. Collective action can be measured in a myriad of ways, but very direct measures of collective action are not conducive to a multi-country, multi-year analysis like the one I employ here. A very basic definition of collective action could be the following: the voluntary participation of a group of individuals in an activity around some shared interest. This basic definition is straightforward but operationalizing collective action into a concept that is measurable is indeed difficult. In the present context of agricultural policy, it is not necessarily the goal to pinpoint which kinds of actions will produce particular and specific outcomes in regards to various public policies. Furthermore, one can think of any number of examples of what might be deemed an activity under this definition of collective action, but are all examples relevant? In other words, are some actions more likely to produce certain outcomes over others and is that hierarchy important? If the goal is to determine which action or combination of actions are more likely to produce $outcome_i$, then a multi-country study is probably not conducive to this line of inquiry. What types of collective action develop in not only any one country, but any one sector within the agricultural sector will likely vary from country to country. This is why I choose to focus on what I call barriers to collective action rather than direct measures of collective action. There are particular environments that seem to be more conducive to collective action and it is more important in this context to try to gauge the environments in which various types of collective action are more likely to occur and therefore, more likely to influence policy.

3.3.1 Civil Society Participation Index

The first indicator I use to measure barriers to collective action is a civil society participation variable. The civil society participation variable was created by the Variety of Democracies (V-DEM) project. The variable itself is an index of four other variables related to civil society that were also created by the V-DEM project. The variables included in the index are the following:

> *Candidate Selection*: this variable measures the centralization of the candidate selection process within parties. The variable itself ranges from 0 to 5, with 0 indicating the most

centralization and 5 the least centralization. A measure of 0 denotes a system in which the parties are solely responsible for choosing their candidates. On the opposite end, a measure of 5 denotes a system which is more democratic in choosing candidates and leaves that responsibility mostly up to the constituents themselves.

CSO consultation: this variable measures the extent to which civil society organizations are consulted on various policy decisions that relate to those organizations' members. The variable ranges from 0 to 2. A measure of zero indicates that CSO's are consulted very little or not at all, whereas a measure of 2 indicates that CSO involvement and consultation is high.

CSO participatory environment: this is a measure of civil society participation rates and it ranges from 0 to 3. If a country has a score of 0 then most associations are state sponsored and are not purely voluntary, whereas a score of 3 means the country has many CSO's and voluntary participation is fairly common.

CSO women's participation: this variable measures the extent to which a country places restrictions on the participation of women in civil society organizations. Countries with scores of 0, 1, or 3 place restrictions on women almost always, frequently, or about half the time respectively, whereas countries with scores of 4 or 5 rarely or never place restrictions on women's participation in CSO's.

According to the V-Dem Project codebook, civil society organizations are where "citizens organize in groups to pursue their collective interests and ideals" (Coppedge et al. 2016, 56). The index itself is made up of the Bayesian factor analysis point estimates of the indicators for the aforementioned variables and is measured on an interval scale. Higher values are associated with civil society environments that are more autonomous from the state and enjoy a more open environment where people may participate freely in various forms of civil society organizations. This variable is of considerable interest to me because it touches on the very concept that I outlined

above: barriers to collective action. If the environment is one in which barriers are quite low, then the people that find themselves in this type of environment may be more apt to organize for their interest.

Another particular aspect of this measure is important with regard to agriculture and that is the component related to women's participation in CSO's. In some areas of SSA, women form the majority of small holder farmers and the FAO estimates that between 1980 and 2010, women accounted for approximately 48%-50% of the agricultural labour force (Doss 2011, 4). Furthermore, this estimate is consistently higher than estimates of women in the workforce in Asia, North Africa, Latin America, and the Caribbean. Compared to employment in manufacturing and services, more women are reliant on agriculture to provide them with employment. Given these patterns, it is important when looking at the barriers to collective action, that there is particular attention paid to those barriers that specifically affect women in agriculture. Quoted below is a description by the then United States Secretary of State Hillary Clinton in 2009 of the struggle faced by women who are small farmers in the developing world:

> "She lives in a rural village in Sub-Saharan Africa, Asia, or Latin America. She farms a piece of land—land she does not own. She rises before dawn and walks miles to collect water—if there is water to be found. . . If she's lucky, drought, blight, or pests don't destroy her crops, and she raises enough to feed her family—maybe even has some left over to sell. But there's no road to the nearest market and no one to buy from her anyway" (Clinton 2009).

The agricultural labor force participation rates among men and women in SSA are nearly equal. Women are also less mobile, less educated, and lack the same training in agriculture compared to men in many parts of SSA, which all contribute to further limits on one's ability to effectively organize for their own interests. Many developing countries have seen a major growth in the number of rural women's groups that empower women serve as an "important forum for women to access and share information from which they are otherwise excluded, a function that deserves explicit attention in group formation" (*Gender in Agriculture Sourcebook* 2009, 66). That being said, the

growth in these groups across developing countries has not been concentrated in SSA although there has been some growth in particular in West Africa (*Gender in Agriculture Sourcebook* 2009, 69).

3.3.2 Rural Population Density

The spatial concentration of farmers affects their ability to organize (Olsen 1985). In SSA, the rural population tends to be more dispersed than the urban population. This dispersion becomes more of a barrier to collective action when combined with inferior infrastructure for roads and communication. This barrier may be mitigated by an increase in the number of large-scale farms, who are better able to organize and make demands in their favor. In the absence of the number and size of farms across time, the rural population density will be used as an indicator for the spatial concentration of farmers. Other studies have similarly pointed out the difficulty that comes with organizing a group that is large in number and lacks the necessary channels for cooperation, but these studies focus on just the size of the rural population (Bates and Block 2009, 2011). The aforementioned studies hypothesize and then confirm in their analysis that larger rural populations lead to more averse policies for agriculture. This makes intuitive sense given what has been established about size of group and successful lobbying attempts. Furthermore, these studies point out that in many instances, farmers can be separated by large distances which are an added obstacle to the already difficult situation when you have a very large group.

I choose to include rural population density rather than the overall size of the rural population because it takes into account two barriers that tend to hinder efforts to collectively organize: large groups and dispersion. I mentioned previously that other research has found that the higher the number of large farms, the better the chances are that individuals will lobby to secure their interests. Although I cannot say with certainty that increases in rural population density means that the number of large farms are growing within a particular country, I do not need to assume that for this particular variable to be useful. Even if increases in rural population density are not due to increases in large farms, the increase itself still tells us something about the potential for increased interaction

among rural people and/or groups. Cooperation and coordination problems are exacerbated by large numbers of people who are dispersed. Coordination problems associated with a lack of communication channels and/or lack of leadership will likely diminish if these dispersed groups are brought together by the existence of larger farms. Similarly, even in the absence of large farms, increasing the proximity of individuals should lessen some of the coordination problems associated with dispersion. However, there is evidence to suggest that rural population density tells us something about the number of large vs. small farms within SSA. Recent studies in agricultural economics show that more households are moving toward agriculture and at the same time, SSA is experiencing a decline in farm size (Chamberlin, Jayne and Headey 2014; Jayne, Chamberlin and Headey 2014).

For this indicator, I construct a measure using two variables from the Food and Agriculture Organization. Rural population density is constructed by taking the rural population and dividing it by the arable land area, which is measured in square kilometers. Arable land area is defined by the FAO "as land under temporary crops, temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow" (FAOSTAT 2015). This variable ranges from 79.15 to 602.60 persons per square kilometer. The mean value is 242.38 persons per square kilometer with a standard deviation of 108.05. Cameroon has the lowest mean value with 119.85 persons per square kilometer, while Kenya has the highest mean value with 386.12 persons per square kilometer.

3.3.3 Asset Specificity

Economic sectors that have difficulty moving assets to other uses should face larger incentives to secure favorable policies. Other studies have shown that firms are more likely to engage in lobbying activities the more costly it is to move to another industry or toward the production of a different good (Alt et al. 1999). Consider, for instance, a maize farmer. If said farmer observes the price of maize diminishing and, simultaneously, that the price of millet is increasing, the farmer could easily switch to producing millet in exchange for better prices. The assets in maize farming

are easily transferable to millet farming. Conversely, consider farmers that are largely invested in crops like cocoa or coffee. These crops require long-term investments in labor, land, and capital; for these types of crops there is a long production cycle and the processing equipment is capital intensive, making the costs of diversifying into other crops much higher for these types of crops. Therefore, groups (sectors) with high asset specificity often have more incentive(s) to organize and mobilize for their policy preferences (Frieden 1991). The asset specificity itself makes it so that policy changes have a greater effect on those groups because it is more difficult to use their assets in a different sector. Any changes in policy affecting sectors with high asset specificity could make or break an individual's livelihood. Research has shown that farmers who invest heavily in crops that have high asset specificity are more likely to join organized farmer associations (Widner 1994*a*).

Typically asset specificity is differentiated by type: site specificity, physical specificity, human specificity, and dedicated assets. Site specificity has to do with the mobility of assets in terms of their location. Site specificity is high when assets are largely immobile once they are situated in their location for a particular use. Physical specificity refers to the physical investments required for a particular economic endeavor, such as specialized machinery, which have lower value when put to other uses. Human specificity refers to the the expertise that is specific to those involved in the economic endeavor. Lastly, dedicated assets are those that rely on a the sale of assets to a particular buyer or buyers and would result in general excess if said buyers were no longer customers. There is greater risk involved in investing in assets which are specific and therefore, necessitate favorable conditions that reduce risk. Therefore, there is an increased incentive to secure higher prices, subsidies, or investments in research & development to offset some of the risk.

One way to get at the level of asset specificity present across the agricultural sector in each country is to look at the use of cropland. If the cropland mostly consists of crops that do not typically have specific assets, then it may be less likely that we will observe farmer mobilization. On the other hand, we may observe more instances of mobilization when permanent crops make up a

larger portion of cropland in a country. Using the World Bank's definition and measures, permanent cropland is the percentage of "land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee, and rubber" (*World Bank Development Indicators* 2012). This variable ranges from a minimum of 0.02% to a maximum of 14.15% with a mean value of 2.43% and a standard deviation of 3.39. The country with the lowest mean value is Zambia at 0.03%, while the country with the highest mean value is Cote d'Ivoire at 8.77%.

3.4 Secondary Explanatory Variables

3.4.1 Excluded population

A measure of ethno-politically relevant groups is available from the Ethnic Power Relations data set (Wimmer, Cederman and Min 2009). The extent to which countries are dominated by ethnic politics should be taken into account because the dominance of ethnic politics crowds out other relevant interests including rural interests. That being said, specific rural interests may very well be tied to specific ethnic groups because often, ethnic groups tend to concentrate geographically and so too does the production of particular crops and farm products. The groups that are considered to be "ethnopolitically relevant" are the groups that have access to executive-level state power based on their ethnicity. Ethnicity is defined by the authors as "a subjectively experienced sense of commonality based on a belief in common ancestry and shared culture" (Wimmer, Cederman and Min 2009, 325). That ethnicity then becomes politically relevant when a political actor maintains that he or she represents members of that particular group. Also, if members of a particular ethnic group or groups are systematically excluded from participating in politics, then this indicates that belonging to some other group or groups confers political power. The excluded population is measured as the percentage of those individuals belonging to a particular ethnic group who do not have access to executive level-state power because their ethnic group is not represented within the executive branch. This variable is a proportion that ranges from 0 to 0.89, with a mean of 0.15 and

a standard deviation of 0.22.

3.4.2 Presidential Systems

There is some evidence to suggest that presidential systems do not produce good governance in the policy areas of economic and human development(Gerring, Thacker and Moreno 2009). In particular, presidential systems tend to suffer from "coordination problems" that result from a more fragmented system of actors and agencies compared to parliamentary systems that are less fragmented and less independent of one another. Furthermore, presidential systems are more likely to maintain the status quo because they are associated with higher levels of policy stagnation, where policy change is more difficult than is observed in parliamentary systems (Cox 2001). Because of these findings, I have included a dummy variable to represent the presence of a presidential system within each country over time. Observations where a country has a presidential system in place during a particular year will get a score of 1 and a 0 otherwise. The data on presidential systems comes from the Database of Political Institutions and covers the years from 1975-2009 on all 14 countries in my sample. Ten of the countries in my sample have only used presidential systems between 1975 and 2009. Of the remaining four countries, Ethiopia has used a presidential system for 21 years, South Africa for 25 years, Uganda for 30 years and Zimbabwe for 22 years.

3.4.3 Executive Tenure

Executive time horizons affect the kind of cost-benefit analysis that politicians use to make decisions on policies. The length of time an executive has been in office will affect the governmentÕs behavior when it comes to policy change. Data on executive tenure comes from the Database of Political institutions and specifically measures the number of years that the executive has been office. The measure itself ranges from 1 to 33 with an average executive tenure of 9.59. This particular variable is only used in the analysis chapter and associated models that deal with agricultural R&D spending.

3.4.4 Natural Resource Endowments

Bates (1980) argued that countries with access to higher levels of revenue from nonagricultural sources, and in particular natural resources, tend to tax agricultural exports less. He uses an example from Nigeria as evidence to support this claim, showing that increases in oil revenues in the 1970's led Nigerian agricultural marketing boards to set more favorable prices for farmers. He did not directly test this assertion in his 1980 work, but did so in his piece with Steven Block in 2009. Countries that have a large natural resource endowment might be less inclined to put as much of a tax burden on other sectors and in SSA, this may lessen the burden that is placed on the agricultural sector. A dummy variable is included in the model to represent those countries that are considered to be rich in natural resources with a value of 1, otherwise, the country will be coded with a value of 0. The original coding scheme comes from Ndulu et al. 2007 and was also used in the Bates and Block piece from 2009.

3.5 Control Variables

3.5.1 Geographic Characteristics

Some geographic characteristics have been shown to impact both governmental policy choice and individual level behavior within the agricultural sector. The conclusions have been mixed with some evidence to suggest that landlocked countries are less biased against agricultural trade than coastal countries (Ndulu et al. 2007), while other studies have concluded that landlocked countries consistently impose unfavorable policy environments for agriculture(Bates and Block 2009). Geographic location is also associated with various other features that will likely affect the agricultural sector in particular like climate patterns, transportation costs, variations in crop production, etc. Because of this, landlocked countries and coastal countries may differ in systematic ways based solely on their geographic location. Not only that, but farmers in landlocked vs. coastal economies may face systematically different constraints.

A dummy variable is included to denote whether or not a country is considered landlocked (1) or coastal (0). Landlocked countries are those whose borders are entirely enclosed by land, while coastal countries share a border or borders with a body of water. Every country in my sample is either consistently landlocked or consistently coastal throughout the time period they are measured except for Ethiopia. Between the years of 1961 and 1993, Ethiopia is coded as coastal, but following Eritrea's independence in 1993, the borders of Ethiopia changed and resulted in their landlocked status. This leaves ten countries that are consistently coded as coastal and three which are consistently coded as landlocked.

3.5.2 Real GDP per capita

Variation in policies and more to the point, variation in agricultural policies may very well be the result of the level of economic development in a particular country. In the developing world, at various points in time, there has been the tendency for governments to enact policies that do not favor agriculture when it comprises the largest category in the workforce and the economy. This particular pattern has remained fairly consistent over the last 50 years within SSA save for a few outlier cases where policies seemed to be pro-agriculture for brief periods or individual years. Growth in per capita GDP within SSA between 1980 and 2010 averaged just 0.26 percent compared to the global average of 1.44 percent(*World Bank Development Indicators* 2012). Given these features, one must control for the impact of per capita income in order rule out the standard relationship between per capita income and agricultural policy choice.

3.5.3 Structural Adjustment Programmes

Favored by the Bretton Woods institutions, Structural Adjustments Programs (SAPs) were the preferred prescription for the economic stagnation experienced by many African countries in the 1970's. The introduction of these SAPs started in the 1980's and continued throughout the 1990's and advocated a "package" of neoliberal prescriptions including the elimination of many subsidies

and credits to agriculture and a commitment to privatization through cuts in public spending. Because many countries in SSA adopted these particular policies, it is possible that the year 1980 and onward are important drivers of the policy choices made in regards to the agricultural sector in subsequent years. Not only that, but when I plot a variety of the series for each country, there is a noticeable structural break that seems to permeate almost every country in the dataset in particular for the civil society participation index and the measure of GDP per capita. Because of this, the variables are displaying what seem to be unit roots based on the diagnostic tests that I run but upon further examination it is clear that the structural break is likely causing the series to fail the diagnostic tests. A further discussion of this topic can be found in chapter 4, where this structural break is pertinent. Therefore, I include a dummy variable to indicate observations that fall within the range of 1980 - 2009 and any years below that range will receive a value of zero. This particular dummy variable is only included in the analysis in chapter 4, which covers determinants of agricultural pricing distortions. I do not include this variable in my analysis for chapter 5 on public agricultural R&D spending because there are only observations that range from 1981 - 2009.

3.6 Data Coverage

My dependent variables of interest are discussed in chapters 4 and 5, which cover the analysis portions of the dissertation. Standard presentations of the panel data models to be used in Chapters 4 and 5 assume that panels are *balanced*; that is, that each unit has an equal number of observations on the same time points (formally, that $T_i = T \; \forall \; i$). In practice, however, panel data are often *unbalanced*, with different numbers of observations recorded for each cross-sectional unit. Unbalanced panels are primarily of concern because they imply missingness in the data; given imbalanced data, a key question is the mechanism by which that missingness occurs (Baltagi 2005).

This is the case in the data used in Chapters 4 and 5. As indicated in Figure 4.4 in Chapter 4, data on RRA are complete for the entire period of study (1961-2009) for seven of the fourteen countries in the study; an additional four countries record data from 1961 to 2005. Of the remaining

three countries, one (Mozambique) has data from 1976-2009, one (Ethiopia) from 1981-2008, and one (Tanzania) from 1976-2005. As can be seen in Figure 5.1 in Chapter 5, we observe a similar pattern of imbalance in the data on AGRD: nine countries have complete data for the 1981-2009 period, with data on Uganda available from 1995-2009, on Tanzania and Zimbabwe from 2000-2009, and on Mozambique from 2004-2009. In each of these instances, the imbalance arises from the absence of blocks of data at the beginning (or, less typically, the end) of the series in question. In each instance, the reasons for the missingness are largely administrative, such that the process driving it is unlikely to be related to either the outcomes of central interest or the models' predictors.

Table 3.2 Summary Statistics: Agricultural Price Distortion Models

Variable	N	Mean	S.D.	Minimum	Maximum
Rural Population Density	339	267.72	120.15	101.34	602.60
Civil Society Participation Index	339	0.64	0.23	0.07	0.94
Permanent Cropland (%)	339	2.61	3.70	0.02	12.31
Political Competition	339	4.68	3.19	1	9
Political Competition (EIEC)	349	0.72	0.45	0	1
Excluded Population (%)	339	0.15	0.22	0	0.89
Presidential System	339	0.91	0.29	0	1.00
Electoral System	339	0.88	0.48	0	2
Log GDP per capita	339	6.48	0.89	4.86	8.70
Resource Rich	339	0.32	0.47	0	1
Landlock	339	0.25	0.44	0	1
Post-SAP Dummy	339	0.08	0.28	0	1

3.7 Conclusion

In summary, this chapter presented the various concepts that are important to understanding the analyses carried out in chapters 4 and 5 and their associated measures and data sources. For some of the concepts, multiple measures are available from different sources and as a result of this, judgements must be made on my part as the researcher about their relative merits. The final

Table 3.3 Summary Statistics: Agricultural R&D Spending Models

Variable	N	Mean	S.D.	Minimum	Maximum
Rural Population Density	277	289.05	114.99	117.18	602.60
Civil Society Participation Index	277	0.69	0.23	0.07	0.94
Permanent Cropland (%)	277	3.14	4.03	0.02	12.31
Political Competition	277	4.91	3.17	1	9
Political Competition (EIEC)	294	0.73	0.44	0	1
Excluded Population (%)	277	0.19	0.24	0.00	0.89
Presidential System	277	0.94	0.25	0	1
Log GDP per capita	277	6.39	0.88	4.86	8.70
Resource Rich	277	0.30	0.46	0	1
Landlock	277	0.25	0.43	0	1
Years in Office	277	9.59	8.00	1	33

collection of measures are the result of a theory-driven process rather than a process based on data-availability.

Additionally, compared to previous studies, the final dataset here covers more country years and measured concepts, with greater attention to the operationalization of the concepts themselves. In this way, I believe my analysis will, at the very least, improve upon previous studies' reliance on a small set of variables based on ill-conceived or badly defined concepts, which in turn lead to the use of questionable measures of those concepts.

Looking ahead, the analyses in chapters 4 and 5 will make use of the measures presented here as explanatory variables in their respective models. With that being said, only brief mentions will be made to the measurement of the variables as they are discussed at length in this particular chapter. And furthermore, even though most of the measures are found in both chapters, the models are not the same and therefore, each chapter will rely on the set of variables that are relevant to the underlying theory for the analysis at hand.

CHAPTER 4

THE DETERMINANTS OF AGRICULTURAL PRICING POLICY IN SUB-SAHARAN AFRICA

4.1 Introduction

Major reforms to agriculture and food policy within Africa have yet to be seen, even in the face of a major food crisis. Mancur Olson argued that a major crisis may undermine the current system so much as to leave room for reform (1982). Previously marginalized individuals and/or groups may be motivated to alter the policy environment if they believe the current system to be failing or to have already failed. Those marginalized groups would consist largely of the poor and more specifically the rural poor, who are net food importers and thus more susceptible to the negative impacts stemming from higher food prices (Wodon and Zaman 2008). Long-term stabilization of food prices is often distorted by "short-term, opportunist, personal and political considerations" (Poulton et al. 2006, 346). Policy experts have consistently recommended that any policy reform dealing with food must protect the interests of the poorest and most vulnerable sectors of society, but most policy reform within Africa has given little support to the rural sector.

4.2 Agricultural Policy via Price Distortions

During the 1980's, agricultural policies came under scrutiny by researchers and international financial institutions alike largely because of poor growth performance, which was attributed to high levels of government intervention in the agricultural sector. The pattern was to insulate domestic agricultural markets from international competition. Within Africa, the pattern has tended toward non-protectionist policies, and in fact, policies have tended to lean with an anti-agricultural bias (Bates and Block 2009). Where agriculture is the dominant sector, the government tended to set prices lower than farmer incomes; where agriculture makes up a smaller portion of the labor force, governmental policies were more beneficial for farmers' incomes(Bates and Block 2009).

Across sub-Saharan Africa, the policy framework directly discriminated against agriculture and amplified the suppression of producer prices (Krueger 1992). The goal of the analysis here is to uncover the factors that contribute to this type of policy framework that tends to plague the region.

I conceptualize agricultural policy as any governmental actions that affect the redistribution of resources to agriculture or correct for market failures (Gorter and Swinnen 2001). One of the major policy instruments used by governments to support agriculture is through interventions in agricultural markets. Agricultural price distortions are some of the most pervasive of all the interventions in agricultural markets. These interventions tend to overly support farmers in high-income countries, usually through subsidies, and over-tax farmers in low-income countries (Anderson 2010; Kerr 1986).

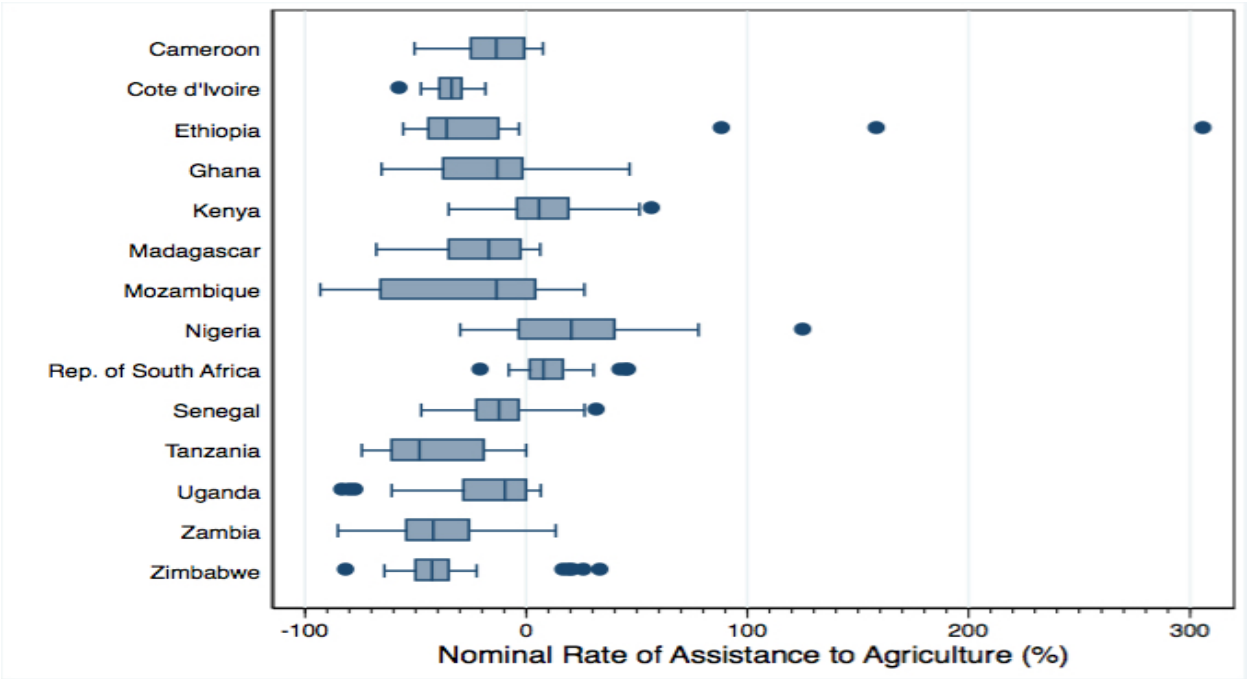
4.2.1 Data Selection: Agricultural Price Distortions

One commonly cited measure of agricultural price distortions is the nominal rate of assistance (NRA) to the agricultural sector. The nominal rate of assistance gives an overall picture of how much the government's policies have either raised or lowered the return to farmers on their products. When the NRA is greater than 0, then the government's policies have resulted in a greater return to farmers than would be the case if the government had not intervened. Conversely, when the NRA is less than 0, the gross return to farmers is lower than it would be had the government not stepped in with distortionary pricing policies. The NRA to agriculture can also be broken down into those NRA's for the import-competing sector and the export-producing sector. Taking both of these tradable sectors together and computing the weighted average percentage gives you the overall NRA for agricultural tradables, or $NRAag^t$. This measure is preferred over other measures because it includes measures of both tariff and non-tariff barriers to imports and exports.

Looking at this particular measure in figure 4.1, we can see quite a bit of variation in the distributions within each country included in my analysis. Across all 14 countries, only three countries have a positive mean value for $NRAag^t$ (Kenya, Nigeria and South Africa). Of the remaining countries, Zambia and Tanzania have the lowest mean values for $NRAag^t$ with averages

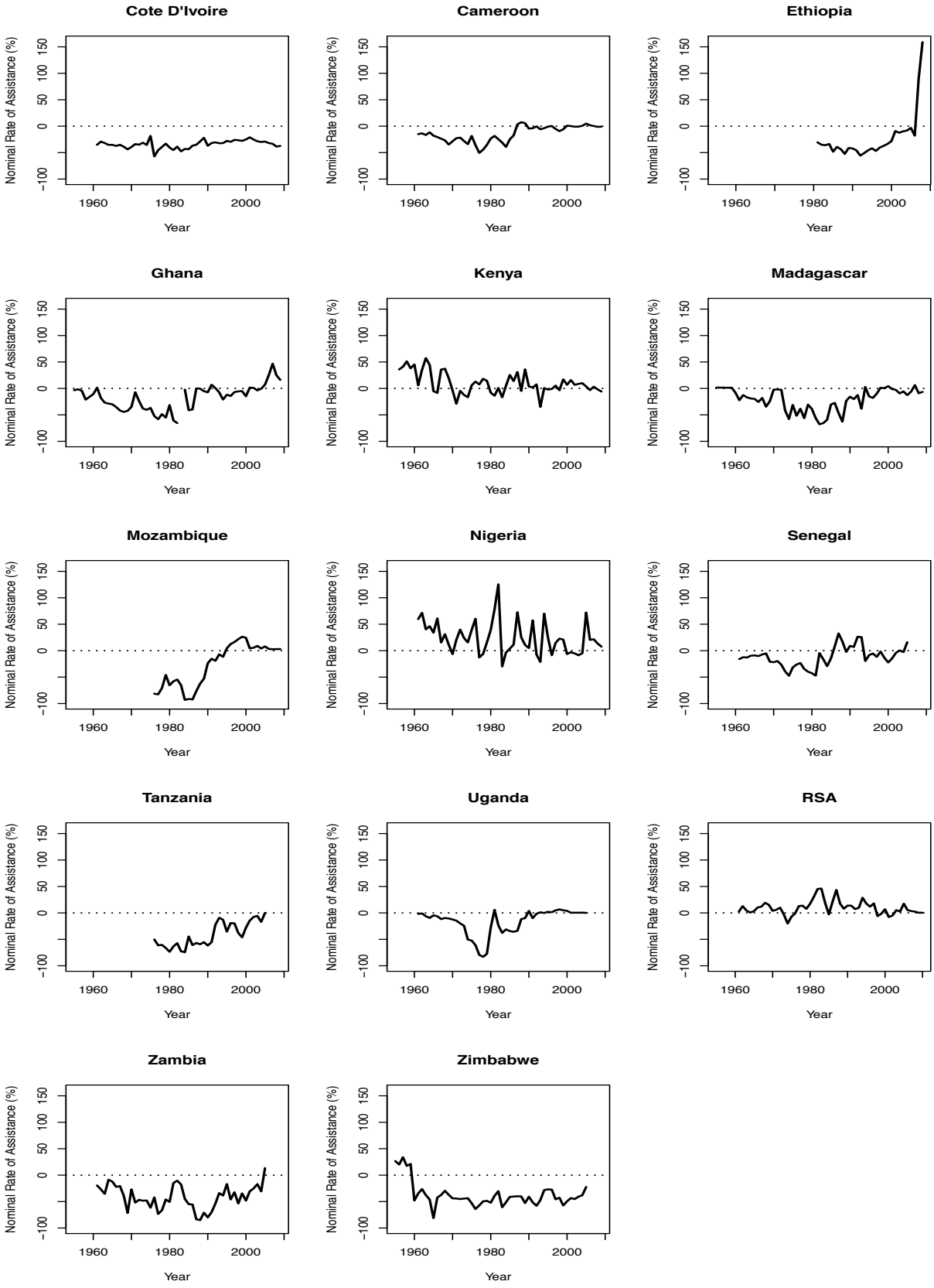
of -41.64 and -41.20 respectively. Looking at figures 4.1 and 4.2 together, Cote d'Ivoire has seen very little variation in $NRAag^t$ across time and trends toward negative $NRAag^t$ values, whereas Mozambique has seen quite a bit of variation across time and also, a clear trend toward increases in their $NRAag^t$ values. Looking at figure 4.2, the $NRAag^t$ values for Tanzania have continued to climb overtime, but have remained negative throughout the time period covered. Since around the year 1980, Cameroon, Ghana and Uganda have see an upward trend in their $NRAag^t$, whereas Kenya and Zimbabwe have largely seen an overall downward trend since about 1960. The series for Ethiopia stands out as one that has a clear spike around 2008 when the Ethiopian government acted in earnest to try to mitigate some of the devastating effects of the food price crisis between 2007-2008 while also responding to a variety of food riots that broke out during the months of March and April, 2008.

Figure 4.1 Distribution of Nominal Rate of Assistance within Countries



The $NRAag^t$ variable is seen as a more *direct* measure of agricultural distortions, but what is more interesting (especially in the context of SSA) is how the agricultural sector is assisted compared to sectors outside of agriculture. Why is this distinction important? For one, it speaks to

Figure 4.2 Nominal Rate of Assistance by Country



the urban-bias argument first articulated by Robert Bates and Michael Lipton, which contends that developing countries trend toward protectionism for industrialized sectors whose workers tend to be concentrated in urban areas. Resources are extracted from rural areas by taxing the agricultural sector very heavily and driving down the prices in the process.

Secondly, governmental policy choices are exactly that: a choice. They are the result of a complex cost-benefit analysis by the relevant policy actors, which reveals the underlying priorities of those actors and the tradeoffs involved in the decision(s) to support particular policies over others. Assuming that all policy options cannot be pursued at once and that any single policy choice might result in benefits for certain groups while other groups either do not benefit at all or are hurt by those particular policies, the relative level of assistance represents how much the government prioritizes policies that assist the agricultural sector vs. all other sectors.

The NRA can be used to compute the Relative Rate of Assistance (RRA), which is defined as "the percentage by which the price of farm relative to non-farm tradables is above what it would be if the national government had not distorted prices in those goods-producing sectors" (Anderson 2010: 7). In other words, the RRA measures the extent to which the government has intervened and assisted the agricultural sector compared to other sectors through distortionary pricing policies. Furthermore, the RRA tells us the extent to which that intervention has either resulted in higher or lower prices for the agricultural sector giving us a clear indication of how this specific sector either benefits or is hurt by the government's choice to intervene in the market. And lastly, not only is the measure relative, it is also aggregate in nature; it does not indicate which specific interventionist policies were chosen among such options as tariffs or export subsidies, but instead gives an overall measure of the extent to which the *collection* of interventionist policies distorts prices[1]. When the RRA is above zero, policies are considered pro-agriculture; when the RRA is below zero, the policy distortions hurt the agricultural sector relative to non-agricultural sector. An RRA equal to zero indicates that both sectors, agricultural and non-agricultural, are assisted equally. The

[1]For a discussion of the various measures included in the estimation of the NRA and RRA measures, please refer to Appendix A

data available on price distortions comes from the Distortions to Agricultural Incentives Database (DAID) by Anderson and Valenzuela (2008) and can be used to compare across countries.

Looking at the plots in figure 4.4, a few things stand out. First, eight out of the fourteen countries reach RRA values above zero at least once during the years for which there are observations. But looking more closely, it is clear that most countries only reach an RRA value greater than zero less than a dozen times, which shows that for the most part, the countries in this sample have trended toward RRA's that are considered anti-agriculture in nature. Another observation to note is that the variable of interest is not observed for all years for every country from 1961 - 2009, which means that the panels are unbalanced. This is further impacted by the measurements on the independent variables as well and as such, the number of observations for each panel will vary[2]. Table 4.1 gives the summary statistics of the relative rate of assistance for each country[3]. Lastly, Ethiopia stands out as a country that might have an observation for RRA that is an outlier; whether or not this is the case will be assessed in greater detail in the section dedicated to the specification of the model used in the analysis.

4.3 Determinants of Agricultural Price Distortions: Institutions

If the common interest is to secure favorable prices, institutions will determine the opportunities available to farmers to demand such prices. Acemoglu and Robinson (2012) argue that countries will "thrive when they develop inclusive political and economic institutions, and they fail when those institutions become extractive and concentrate power and opportunity in the hands of only a few" (page number). State-run monopsonies were very popular during the post-colonial time period in the region and pervasive taxation of the agricultural sector was a preferred strategy to fund industrialization. As Hoeffler (2011) points out, bureaucrats charged with implementing agricultural policies were largely unfit to hold their positions and lacked the experience or training

[2]A longer discussion on the unbalanced panels can be found in Chapter 3, Section 3.5

[3]The summary statistics in this table are calculated using the observations that are included in the full model found in table **??**

Figure 4.3 Distribution of Relative Rate of Assistance within Countries

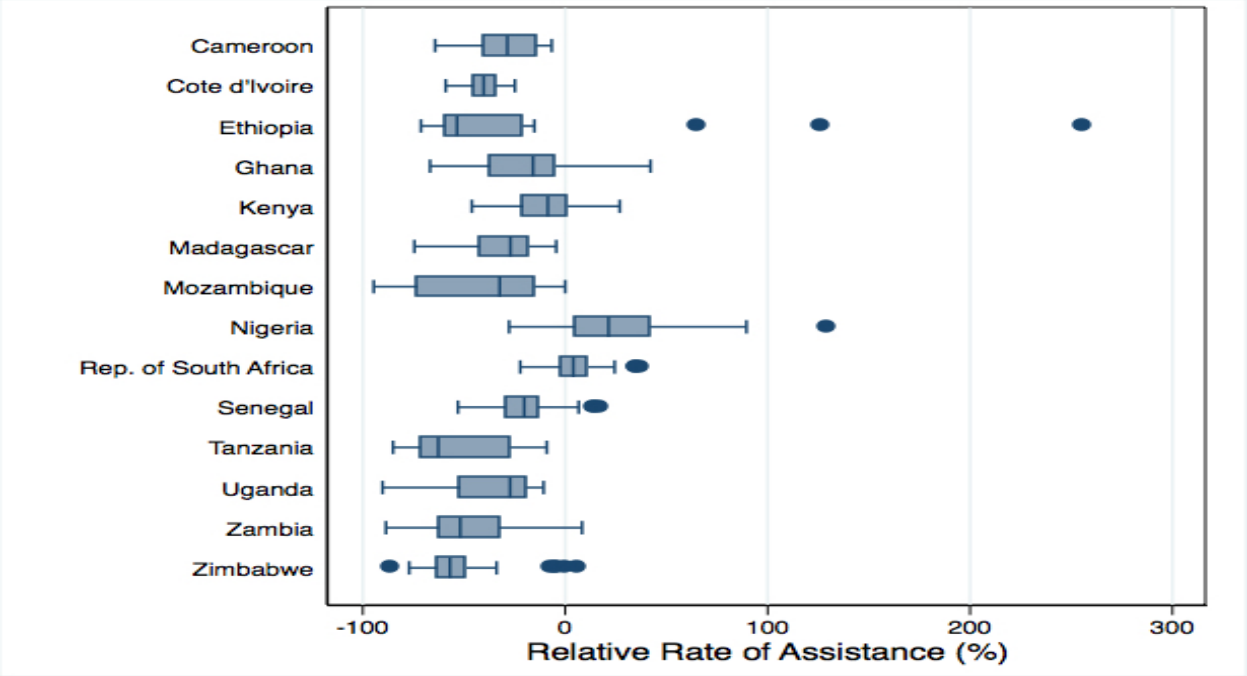
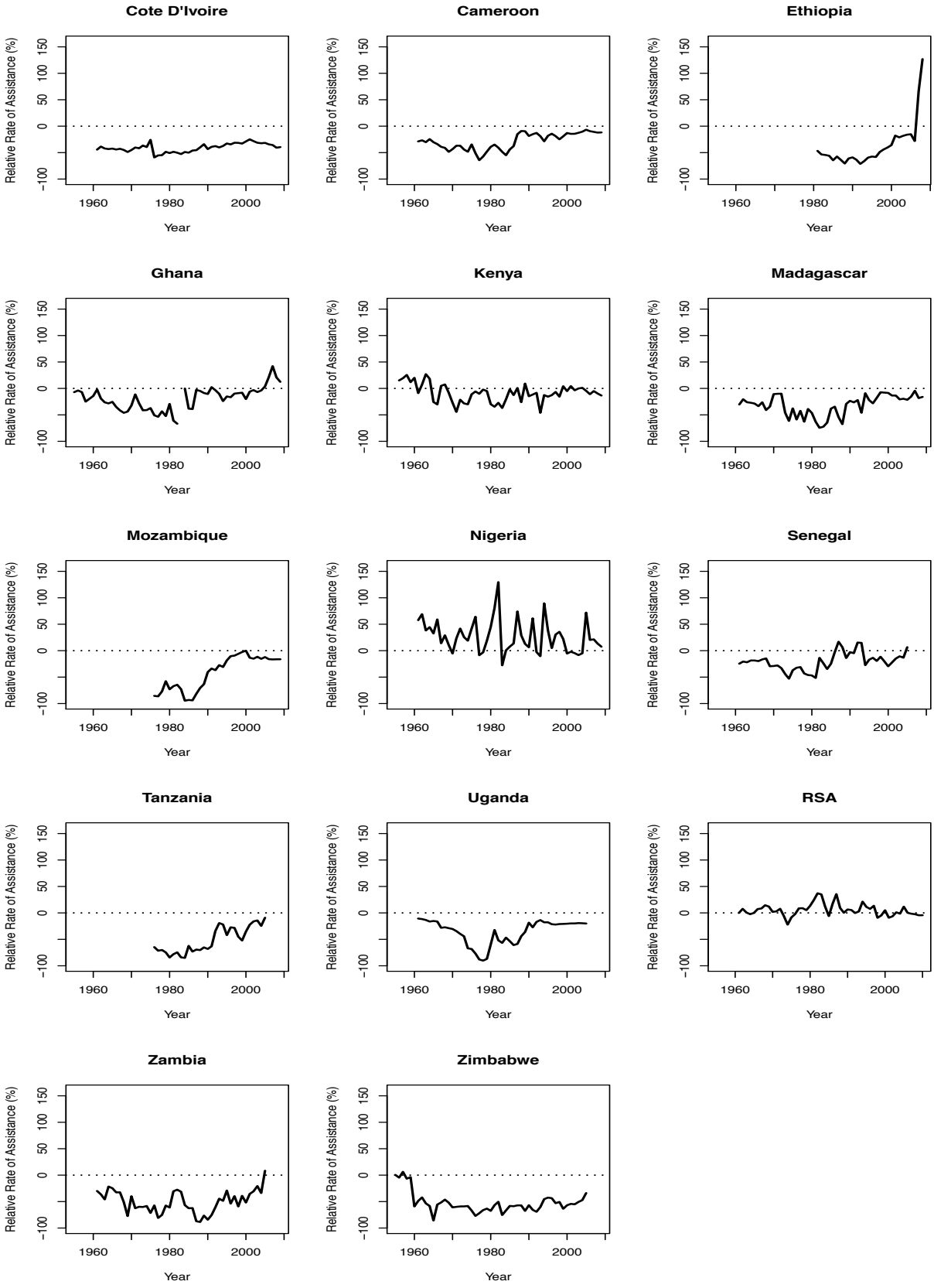


Table 4.1 Summary Statistics: Relative Rate of Assistance across countries

Country	N	Mean	S.D.	Minimum	Maximum
Cameroon	35	-25.52	16.64	-64.27	-6.68
Cote d'Ivoire	27	-41.62	9.66	-59.06	-24.86
Ethiopia	18	-8.29	81.84	-70.60	255.86
Ghana	19	-6.46	21.80	-60.86	42.12
Kenya	35	-11.45	12.33	-46.13	9.16
Madagascar	9	-17.83	12.80	-45.98	-7.25
Mozambique	24	-27.44	25.40	-94.00	0.00
Nigeria	14	24.01	43.35	-27.71	129.55
Rep. of S. Africa	33	6.46	12.45	-9.28	37.09
Senegal	29	-16.54	18.44	-51.59	16.88
Tanzania	16	-43.15	22.80	-73.18	-9.09
Uganda	16	-19.77	2.87	-27.25	-13.59
Zambia	31	-52.43	22.45	-88.59	8.32
Zimbabwe	25	-55.89	9.37	-75.45	-33.91
Total	331	-22.56	33.26	-94.00	255.86

Figure 4.4 Relative Rate of Assistance by Country



necessary to effectively carry out those policies. Further, Hoeffler (2012) argues that "the agricultural sector became popular for rewarding lucrative positions and kickbacks for family, friends and kinsmen, as well as relatively uncontrolled and unaccounted sources of money and assets" (p. 37).

Following this time period came massive institutional reforms in the 1980's that were geared toward market liberalization through structural adjustment programs. These removed many of the institutions that allowed for state-run markets in the hopes that it would allow for more competitive agricultural markets. However, many of the institutional reforms were slow or non-existent and the provision of public goods deteriorated as a result (Hoeffler 2011). Then came a wave of democratization in the region in the 1990's which, of course, instituted more democratic institutions in the region and opened up opportunities for political participation. What follows is a discussion of the relevant institutional features that should, according to my theory, impact agricultural pricing policies.

4.3.1 Electoral System and Electoral Competition

The electoral strategies that politicians choose will depend on the electoral system in place and therefore, will impact the types of policies that politicians will pursue given the electoral rules. In newer democracies like those seen in SSA, patronage systems are often still very much entrenched and plurality/majority type systems might encourage their continued existence because of their tendency to incentivize candidate-centered strategies over party-centered strategies. Plurality/majority electoral systems tend to produce candidates who are more prone to strategies that rely on cultivating a "personal vote" which encourages rent-seeking among groups of voters in a personalistic manner. These kinds of behaviors tend to break down or blur the line of accountability between policy (governmental) actors and their policy decisions, thereby making it easier for those in plurality/majority systems to skirt blame when policies do not align with the majority of voters' preferences. Because the agricultural sector makes up a majority of the workforce in most countries in SSA, it is less likely that policies will reflect the majority's will in plurality systems compared to proportional representation or mixed systems. Furthermore, Olper and Rai-

mondi (2013) find that countries which reform toward more proportional representation systems (as opposed to plurality/majoritarian systems) tend to produce policies that are more protectionist toward the agricultural sector vs. all other sectors.

Hypothesis 4.1.a *Countries with proportional electoral systems will have higher relative rates of assistance than countries with plurality/majority systems.*

Hypothesis 4.1.b *Countries with mixed electoral systems will have higher relative rates of assistance than countries with plurality/majority systems.*

Other studies give weight to the argument that higher levels of political competition may overcome the barriers associated with large groups and their difficulty organizing around a common interest. As politicians are faced with more electoral competition, they are forced to appeal to more voters and since the rural sector is so large, it will be more likely that they will try to expand their support through policies that will confer benefits to those who depend on agriculture for their livelihood (Falkowski and Olper 2013).

Hypothesis 4.2 *As political competition increases (decreases) within a country, the relative rate of assistance increases (decreases).*

4.3.2 Ethnic Group Exclusion/Inclusion

Across sub-Saharan Africa, it tends to be the case that the public's interests are represented by ethnic groups, which act similarly to interest groups. When the government is made up of only one (possibly two) ethnic groups and the country is simultaneously very diverse, it is very likely that the group in power represents a very small minority of the population. When this is the case, it should be more likely that the small minority in power will concentrate their efforts on policies that redistributes only to co-ethnic members. Ethnic groups also tend to make-up what are called "ethnic nations" within the country's borders itself and certain ethnic groups tend to be associated with the production of particular crops because of their geographic concentration (Kimenyi 1998,

2003). If individuals belong to the minority ethnic group in power and are largely employed in the agricultural sector, then policies might favor the agricultural sector in those cases because price supports through subsidies can be more narrowly targeted to particular agricultural goods as well. On the other hand, if more ethnic groups are represented in governmental posts and must share power and policymaking responsibilities, it will be more likely that policies will be more broad-based (Collier 2007). Because the urban population is more likely to react negatively to spikes in food prices, then keeping prices lower (less agricultural price supports) will confer more electoral support if the government can also distribute more in public goods, like education spending, that would also benefit rural voters. Taking all of this together, I hypothesize the following:

Hypothesis 4.3 *As the excluded population increases (decreases) within a country, the relative rate of assistance increases (decreases).*

4.3.3 Presidential vs. Parliamentary Systems

As some studies have shown, executive regime type influences the types of policies promoted. Olper and Raimondi (2013) find that institutional reform toward presidential democracy (as opposed to reforms toward parliamentary) results in more protection for the agricultural sector but that relationship is weakly significant. Furthermore, others have argued that presidents in African countries tend to be more prone to removal through force and therefore, might be motivated by this underlying threat (Kim and Bahry 2008). Because the urban population is more likely to participate in actions that call for the removal of the executive, presidents might be more likely to respond to these threats through policies that appease the urban population. This might result in policies that favor lower food prices, which would not assist the agricultural sector in general. For these reasons, I do not specify the direction of the relationship between executive regime type and the relative rate of assistance.

4.4 Determinants of Agricultural Price Distortions: Collective Action

4.4.1 Group size and Proximity

As the argument goes, the larger and more dispersed a group is, the harder it will be to organize for a common goal. Most studies concerned with the rural sector's capacity to initiate action on their own behalf, take the size of the group into account by measuring the size of the rural population overall. This particular measure will give a sense of how big the group is but not necessarily how dispersed it is likely to be. For this reason, I constructed a measure of rural population density, which gets at both the issue of size and dispersion that plagues the agricultural sectors in developing countries. If the group is large but concentrated in smaller areas, it may be more likely that their paths may cross enough that their inclination will be to participate with one another rather than not, given that it is often the case that individuals with shared ethnicity and language tend to occupy similar areas and produce similar crops.

Hypothesis 4.4 *As rural population density increases (decreases) within a country, the relative rate of assistance increases (decreases).*

4.4.2 Civil Society Participation

Not surprisingly, when institutions and rules make it very difficult for people to participate in politics more directly, the opportunities to engage in collective strategies to influence policy will be diminished. As the barriers to participation are removed and participation is encouraged, the more that governmental policies should reflect the will of the people. This should be particularly true for those groups who often face more difficulties when organizing with others for their collective interests. Those groups tend to be among the rural poor, which means that institutional environments that do not encourage participation or in fact place many barriers on participation, will largely impact those most reliant on favorable pricing policies.

Hypothesis 4.5 *Countries with more open (closed) civil society environments will have higher (lower) relative rates of assistance.*

4.4.3 Asset Specificity

How mobile the factors of production for a particular sector can have a motivating impact on the group's incentives to collectively organize for their interest. When factors are imperfectly mobile across sectors, studies have shown that the owners of these factors of production will be more likely to lobby for policies in their interest (Alt et al. 1996, 1999). When assets or factors are imperfectly mobile or immobile, they are said to be highly specific. Economic sectors that are characterized by very specific assets have very little options outside of the production of that particular good because of the difficulty associated with redirecting the assets toward the production of another good or toward some other use entirely. As Alt et al. (1999) argue, these firms should place greater weight on political activities like lobbying and in particular for policies that produce subsidies, so that others can be excluded from "some of the benefits received so that free-riding does not become an important alternative" (p. 99). The agricultural sector tends to be characterized by high asset specificity. Because of this, the asset turnover also tends to be lower. Asset turnover refers to the amount of revenue that is generated per dollar of assets used. Asset turnover can be increased by increasing revenues (either through higher prices through the products or selling more of the product) or by decreasing the costs of the assets. Farmers that produce crops that require more specific assets should be more likely to lobby for policies that protect prices for those crops.

Therefore, I expect that countries with large proportions of permanent cropland[4] will produce an environment that incentivizes those farmers to lobby for their collective benefit by way of price controls and subsidies.

[4]This pertains to "land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee, and rubber" (*World Bank Development Indicators* 2012)

Hypothesis 4.6 *As the percentage of permanent cropland increases (decreases) within a country, the relative rate of assistance increases (decreases).*

4.5 Control Variables

4.5.1 Economic Development

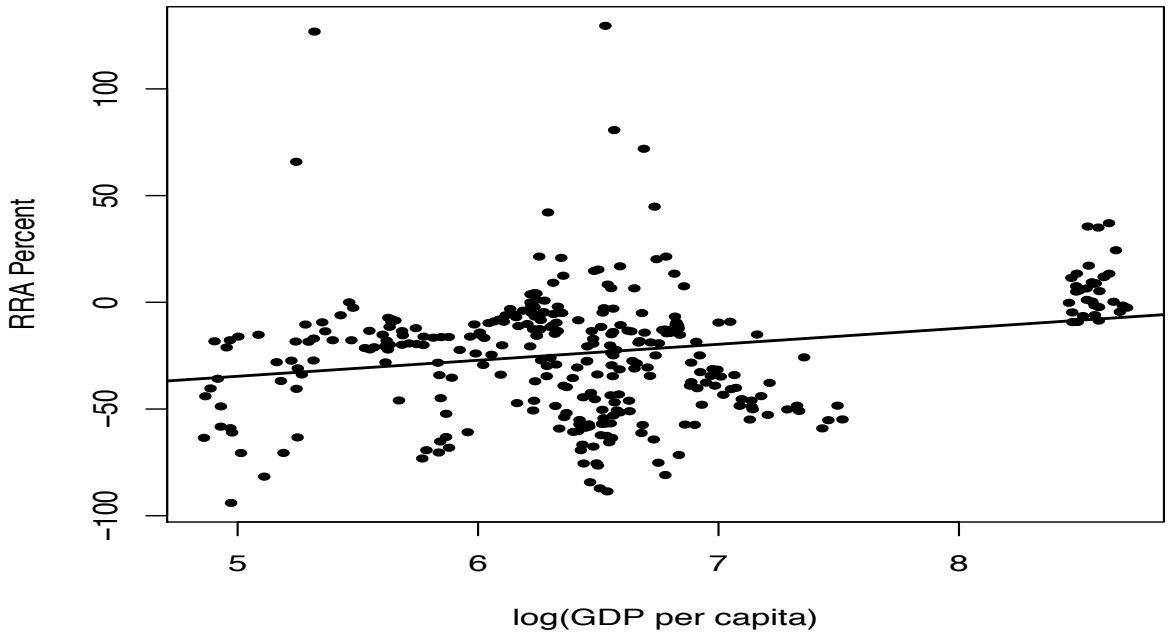
There tends to be a positive association between economic development and the relative rate of assistance to agriculture. Looking at figure 4.5, there is a slight, positive association between the log of GDP per capita and the relative rate of assistance when the country data is pooled. When the plots are disaggregated by country in figure 4.6, the pattern of association is not consistently positive. In Cameroon, Cote d'Ivoire, Kenya, Madagascar, Senegal, Uganda, Zambia, and Zimbabwe the association is negative, but only in Cote d'Ivoire is that correlation both negative and statistically significant. Among the positively associated countries, Ethiopia, Ghana, Mozambique, and Tanzania all display positive and statistically significant correlations between the log of GDP per capita and RRA, while Nigeria and South Africa's positive correlation is not statistically significant.

Less developed countries face a variety of constraints and limitations in the policy-making process that other more developed countries may not face. Therefore, it is imperative to rule out the influence of economic growth on pricing policies. According to research by Anderson and Bruckner (2012) the direction of the relationship is one in which the relative rate of assistance affects economic development and not the other way around. Looking specifically at countries in sub-Saharan Africa across the years 1960-2005, they find that the relative rates of assistance are not impacted by changes in real GDP per capita and instead find that real GDP per capita is negatively affected by the relative price distortions. Even so, it makes sense to include a measure of economic growth as a control variable given the size of the agricultural sector in most countries in the sample. On average, agriculture has made up about one-third of total GDP across sub-Saharan Africa for the last 50 years (*World Bank Development Indicators* 2012). If a sector's contributive

share in the economy is in any way related to whether or not resources are then funneled their way through some set of redistributive policies, then economic growth must be considered as a control in this analysis.

Hypothesis 4.7 *Increases in economic development (GDP per capita) will result in higher relative rates of assistance.*

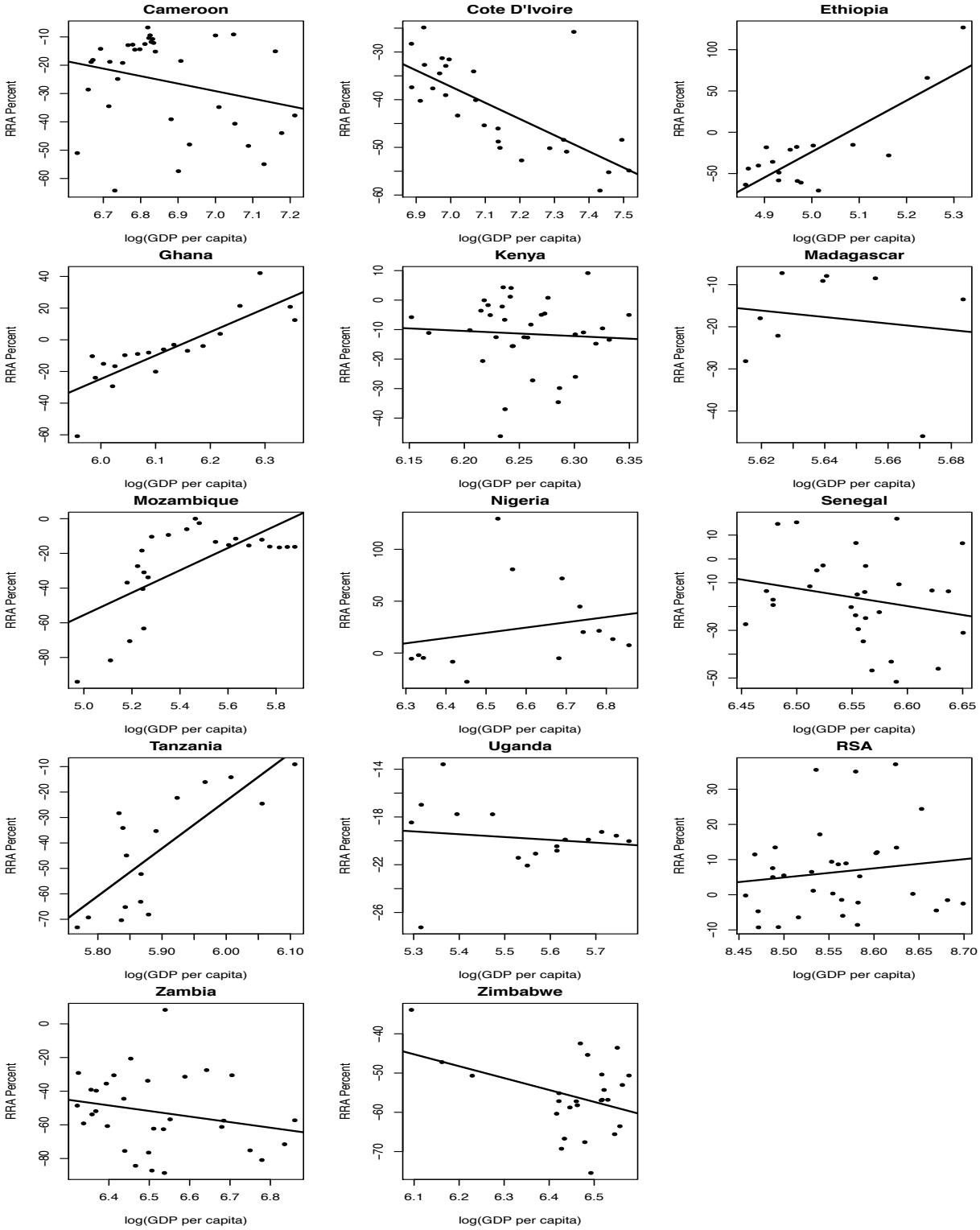
Figure 4.5 RRA by GDP per capita (aggregate measures)



4.5.2 Resource Endowments and Geography

Natural resource endowments are intimately linked with not only levels of economic development in a particular country but also redistributive policy. When governmental actors have access to multiple sources of rents, it may be less likely that they enact policies that will extract rents from the agricultural sector. This relationship may be seen in particular in those institutional environments that incentivizes politicians to extract rents in order to redistribute them to patrons through patron-client networks. Furthermore, geographic characteristics of the country may impact decisions

Figure 4.6 RRA by GDP per capita across countries



over agricultural pricing policies. Ndulu et al. (2007) find that landlocked countries are less likely to enact policies that are biased against trade, whereas coastal countries are more likely to embrace policies that are biased against trade. Bates and Block (2009) find that landlocked countries are more likely to enact policies that are unfavorable toward agriculture compared to the non-agricultural sectors when it comes to protection vs. taxation. Because of these findings, I hypothesize the following about resource rents and geography:

Hypothesis 4.8 *Resource rich countries will have higher relative rates of assistance than resource poor countries.*

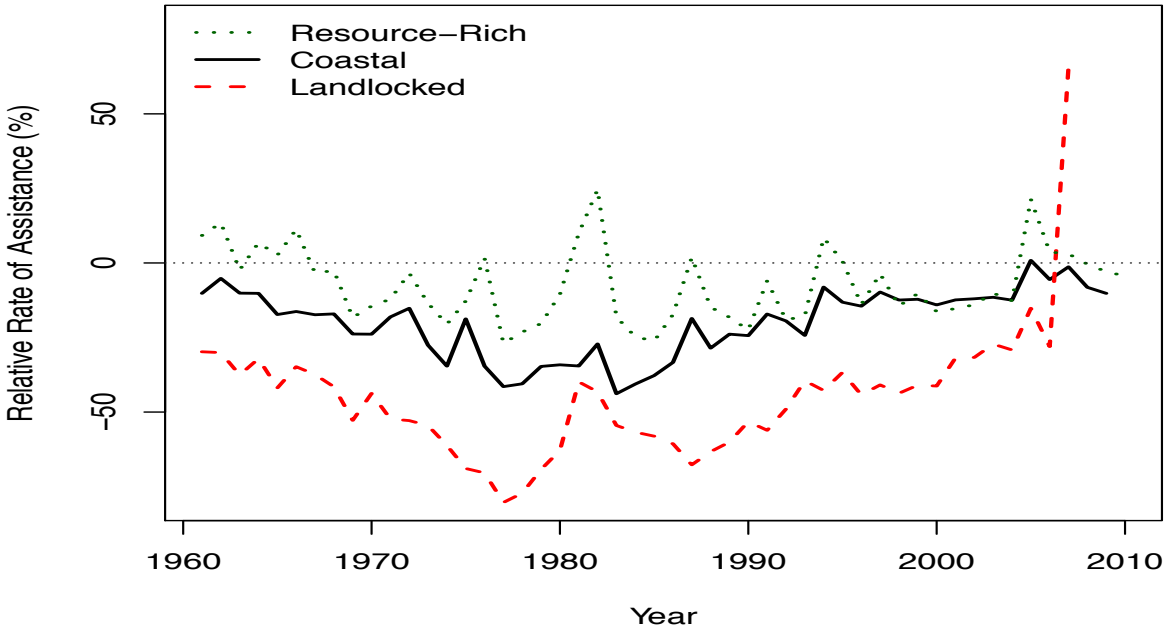
Hypothesis 4.9 *Coastal countries will have higher relative rates of assistance than landlocked countries.*

It follows that coastal countries that are resource rich should produce policies that are much more favorable toward the agricultural sector vs. the non-agricultural sector than countries that are resource poor and landlocked. Therefore, I include an interaction term between the resource rich variable and the landlocked variable where a value of 1 indicates that the country is both resource rich and landlocked.

4.5.3 Structural Adjustment Period

One variable that is indeed necessary to control for is impact of the structural adjustment period on agricultural pricing policies. During the structural adjustment period in sub-Saharan Africa, many countries entered into agreements with the Bretton Woods institutions, agreements that necessitated quick and substantial institutional reform based in large part on the Berg Report from 1981. The Berg Report argue that food insecurity in the region was largely due to governmental policies that overvalued exchange rates and set up marketing boards that overtaxed the agricultural sector to divert the revenues to other uses (Berg 1981). The structural adjustment programs that followed largely diminished the role of the state in pricing policies in the agricultural sector in order liberalize markets and encourage trade. Therefore, during and following the structural adjustment

Figure 4.7 Relative Rate of Assistance by Resource Rich, Landlocked, and Coastal



period in particular, relative rates of assistance should be lower because of the loan agreements made between countries and various NGO's. This period includes the years 1980-2009. My last hypothesis is as follows:

Hypothesis 4.10 *The pre-structural adjustment period will have higher relative rates of assistance than the post-structural adjustment period.*

4.6 Hypotheses and Model Choice

Table 4.2 summarizes all of the hypotheses specified in sections 4.3-4.5; what follows in the subsequent sections is a discussion of the analyses and the results.

4.6.1 Model Estimation

Because my data is measured both across units and over time, I must take into account the various methodological difficulties associated with this kind of data. When analyzing the linear relation-

Table 4.2 Hypotheses: Determinants of Relative Agricultural Price Distortions

Variable	Directional Test	Non-directional Test
Rural Population Density	(+)	
Civil Society Participation	(+)	
Permanent Cropland	(+)	
ln(GDP per capita)	(+)	
Resource Rich	(+)	
Landlocked	(-)	
Post-Structural Adjustment Period	(-)	
PR vs. plurality/majority electoral system	(+)	
Mixed vs. plurality/majority electoral system	(+)	
Political Competition	(-)	
Presidential System		(x)
Excluded Population	(-)	

ship between the dependent variable and independent variable (using time-series cross-section data) the error process of the models is a complicated one. First, ordinary least squares (OLS) regression assumes in its estimation that the errors themselves are independent or uncorrelated with one another. For time-series cross-section (TSCS) data, a violation of this assumption means that serial correlation is present where the errors within units are temporally correlated. Another assumption of the OLS model is that the error variance is constant across variables. If the error variance is not constant across units, the estimated standard errors may be inaccurate and biased downward, which may lead one to incorrectly reject the null hypothesis. In TSCS data, this assumption is often violated for reasons specific to each of the units: unmodeled unit heterogeneity becomes part of the error term and if the differences from one unit to the next is substantial, then the errors will vary with respect to the unmodeled or unobserved factors across units. And lastly,

a final major concern with TSCS data is the issue of non-stationarity, where the series do not display a consistent data generating process in the means, variances and covariances. In the presence of non-stationarity, standard errors are likely to be underestimated and therefore, may result in more Type I errors. Given the complicated error structure persistent in TSCS data, I will address the concerns briefly here while providing more specific explanations and diagnostic tests in the Appendix[5].

In the presence of heteroskedastic errors and serial correlation in the errors, the coefficient estimates β will still be unbiased in large samples but the inferences we make about those covariates may be affected by artificially small standard errors. In Beck and Katz's seminal work on the estimation of TSCS models, they advocate the use of panel-corrected standard errors (PCSE) over other methods of corrections that deal with the presence of spherical errors[6]. PCSE's are often used because they adjust the errors to deal with heteroskedasticity and essentially inflate the standard errors in lieu of this error structure (Beck and Katz 1995). In this estimation technique, the data are pooled across the panels into one dataset and then ordinary least squares is applied across the pooled data. Second, if autocorrelation in the errors is present, one must adjust for this by essentially removing the autocorrelation in the errors either by including a latent dependent variable (LDV) or transforming the data. Lastly, panel correct standard errors are estimated with the following distributional characteristics.: $\varepsilon\ N(0, \Omega_{NT})$. The variance-covariance matrix Ω_{NT} takes into account heteroskedasticity, first-order serial correlation and contemporaneous correlation resulting in the following contemporaneous covariances: $\hat{\Sigma}_{i,j} = \frac{\Sigma_{i,j}^{T} e_{i,t} e_{j,t}}{T}$. In order to determine if serial autocorrelation is present in the data, I utilize the Wooldridge (2002) test of no serial correlation in the errors and fail to reject the null hypothesis, which allows me to estimate the model without specifying an autoregressive parameter.

Lastly, one other issue must be addressed when dealing with TSCS data that is specific to the

[5]To see a discussion of the diagnostic tests in full, see Appendix A

[6]Specifically, feasible generalized least squares (FGLS) methods, which requires that the variance-covariance is known and show that in situations where N>T, the standard errors will be biased

time series nature of the data. Time series data must be stationary in order to remove some of the impact of exogenous shocks to the estimation of the errors over time. After performing various tests for the presence of unit roots in my dependent and independent variables, I find that two variables, namely GDP per capita and the civil society participation index, fail to reject the null hypothesis that all panels contain a unit root, which means that at least one panel has a unit root[7]. Given the presence of a unit root in the aforementioned independent variables, one option is to first difference the data or use a dynamic panel-data model such as the Arellano and Bond (1991) estimator. Using either of these methods raises both estimation and theoretical concerns. The goal in using first differenced data when estimating a panel model is to largely account for exogenous variance that might not be accounted for in the model itself. If this exogenous variation is driving the relationships, it can result in spurious regression results. The tests themselves are sensitive to structural breaks in the series; in other words, if there is a one-time change that fundamentally changes the data generating process of the series, the unit root tests may incorrectly lead the researcher to a Type II error (Perron 1989). There are specific time points at which I might expect that there would be structural breaks within my particular sample of countries given characteristics of the region itself.

Looking at the time series graphs of the two offending variables, the log of GDP per capita and the civil society participation index, a pattern seems to emerge in the time trend. A dashed line is included at the year 1980 to make the pattern more apparent, but theoretically it makes sense that we might observe a non-zero change in the behavior of the series for these two variables. For one, the year 1980 represented a time period in which exogenous shocks such as major commodity price spikes and the imposition of structural adjustments programs were common for many countries in the region. The resultant policies following recommendations from outside organizations such as the IMF and the World Bank produced mixed results, but overall the programs themselves prescribed marked reforms to agricultural markets which necessitated major institutional reforms. Furthermore, economic success was not expected to materialize until 1994/5 under the new adjust-

[7] A discussion of the various tests are contained in Appendix A.

ment programs. With this long timetable in mind, it should be of no surprise that many countries were only partially committed to reforms, which would explain the differences across countries in the trends that are present in figure 4.8 across the GDP per capita series. Furthermore, regime changes to democracy were on the rise toward throughout the period of 1974-1990, with the third wave of democratization reaching sub-Saharan Africa in the late 1980's (Huntington 1991). Due to this, it should not be surprising that there is a structural break in the civil society participation series around the year 1990, which can be seen visually by looking at figure 4.9. Therefore, it seems that a structural break occurred around the year 1980 and might account for the failure to reject the null in the unit root tests. To my knowledge, there is no test for structural breaks vs. unit roots in the panel data setting, although there are tests in the time series setting. That being said, because I am using a pooled model under the Beck and Katz specification, I can rely on the large-sample properties of the data to minimize the spuriousness of regression results that tend to come with unit root processes. Specifically, I turn to the following explanation for clarity:
"Now suppose that there are panel observations of $Y_{i,t}$ and $X_{i,t}$ with large cross sectional and time series components. In this case, even if the noise in the time series regression is strong, the noise can often be characterized as independent across individuals. Hence, by pooling the cross section and time series observations, we may attenuate the strong effect of the residuals in the regression while retaining the strength of the signal $X_{i,t}$. In such a case, we can expect a panel-pooled regression to provide a consistent estimate of some long-run regression coefficient"(Phillips and Moon 1999).

With this in mind, the final model is estimated using this equation:

$$\begin{aligned} RRA_{i,t} =& \beta_0 + RuralPopDens_{i,t}\beta_1 + CivSocPart_{i,t}\beta_2 + PermCrop_{i,t}\beta_3 + \\ & LogGDPpc_{i,t}\beta_4 + RR_{i,t}\beta_5 + LL_{i,t}\beta_6 + (RR_{i,t} \times LL_{i,t})\beta_7 + \\ & PostSAP_{i,t}\beta_8 + prElecSys_{i,t}\beta_9 + mixElecSys_{i,t}\beta_{10} + \\ & PolComp_{i,t}\beta_{11} + Presidential_{i,t}\beta_{12} + ExcludePop_{i,t}\beta_{13} + \varepsilon_{i,t} \end{aligned} \tag{4.1}$$

Figure 4.8 Time Series of GDP per capita

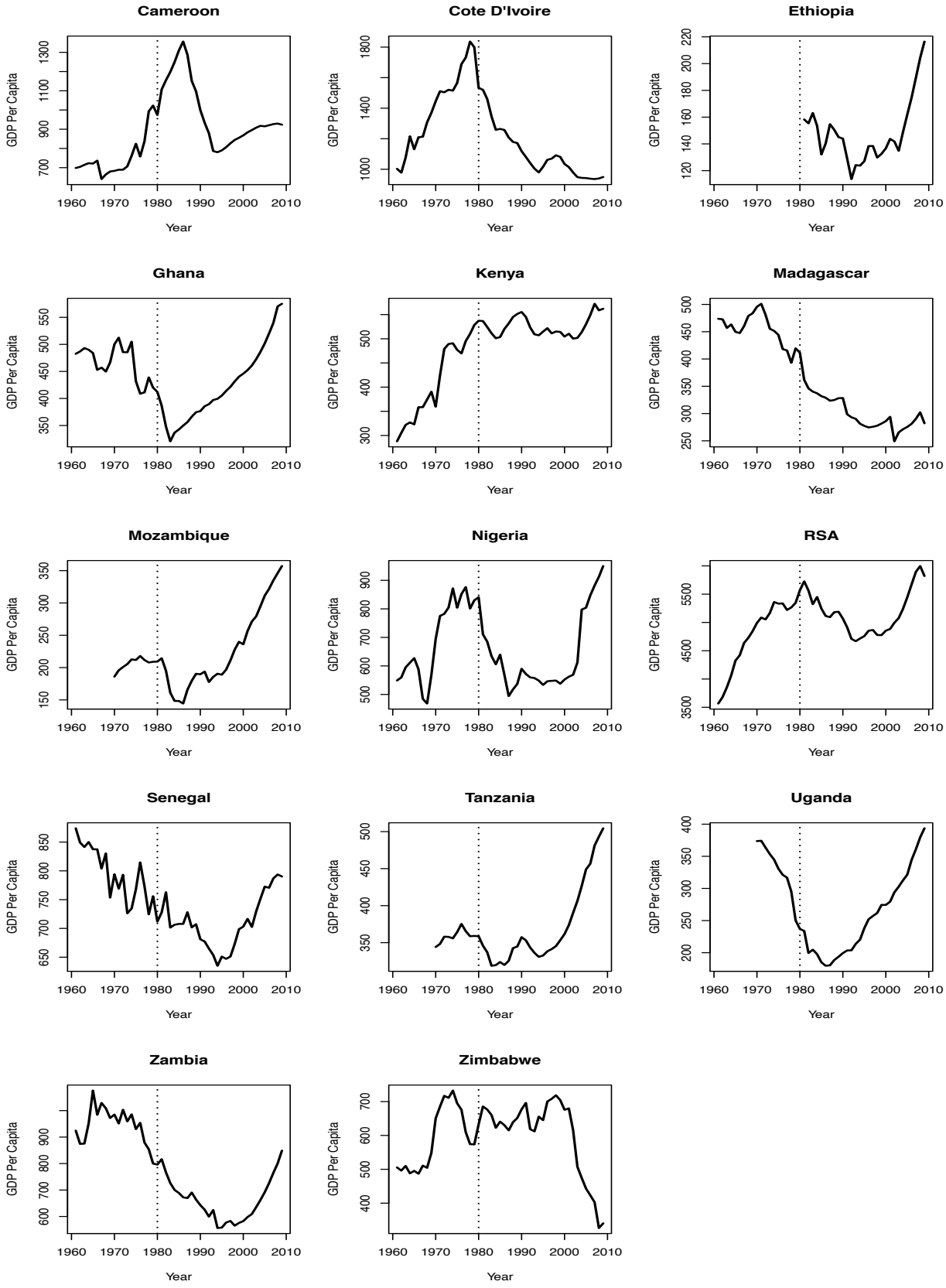
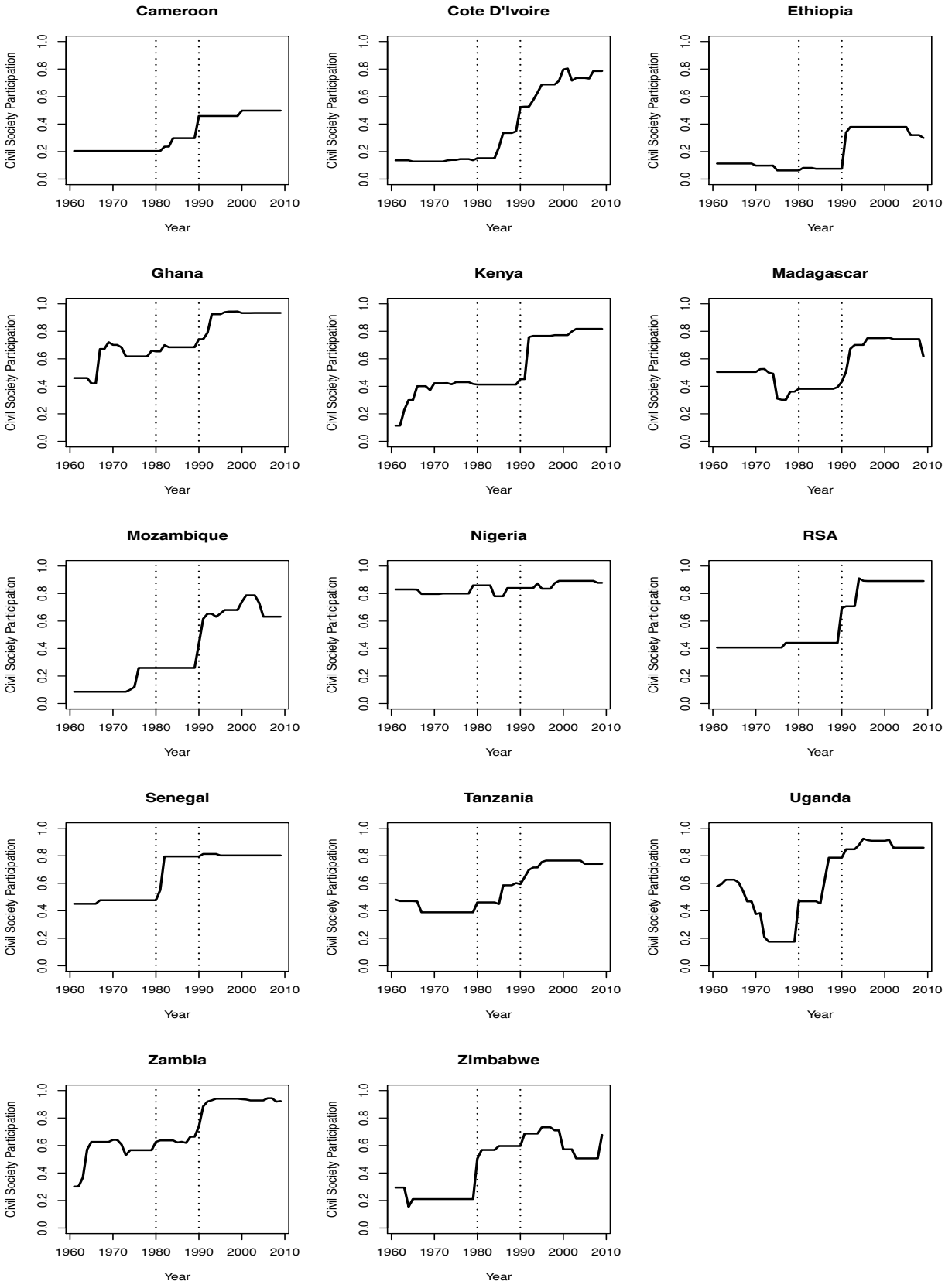


Figure 4.9 Time Series of Civil Society Participation Index



$$i = 1, ..., N;$$

$$t = 1, ..., T$$

The results of the analyses are found in tables 4.3 - 4.4. Model 1 is the collective action model which utilizes the three collective action indicators that I discussed above along with various control variables of interest. Model 2 contains the institutional variables of interest along with the various control variables. Lastly, model 3 specifies the full model with collective action indicators, institutional variables and control variables. Table 4.4 contains the coefficients from the full model with and without the identified outlier for comparison.

4.6.2 Collective Action Model

Within table 4.3, model 1 presents the results of a specified model that only includes the collective action indicators of interest which are rural population density, civil society participation and percentage of permanent cropland. Based on the hypotheses above, the expected relationships are the same for all three collective action indicators: higher levels on the collective action indicators should be associated with higher values of the relative rate of assistance. The following equation is estimated for model 1:

$$\begin{aligned} RRA_{i,t} =& \beta_0 + RuralPopDens_{i,t}\beta_1 + CivSocPart_{i,t}\beta_2 + PermCrop_{i,t}\beta_3 + \\ & LogGDPpc_{i,t}\beta_4 + RR_{i,t}\beta_5 + LL_{i,t}\beta_6 + (RR_{i,t} \times LL_{i,t})\beta_7 + \\ & PostSAP_{i,t}\beta_8 + \varepsilon_{i,t} \end{aligned} \tag{4.2}$$

$$i = 1, ..., N;$$

$$t = 1, ..., T$$

Looking specifically at model 1, civil society participation and rural population density are both significant and in the expected direction. Based on this reduced form model, a one unit change in the civil society participation index while holding all other variables constant increases the predicted value of the relative rate of assistance by 46.89. The coefficient on rural population density

reflects a positive relationship: a one unit increase in rural population density is associated with an increase on RRA by 0.11 holding all other variables constant. The coefficient on permanent cropland is negative, which is not in the direction that I expected, but it is also not significant at the 0.05 level. The coefficients on the control variables also support my predictions. For instance, the coefficient on resource rich is positive and significant and suggests that countries with large resource endowments should have higher RRA's on average compared to countries that are not resource rich. Furthermore, the coefficient on the dummy for the period following 1980 is also positive and significant as I expected. The landlocked dummy displays the expected relationship (negative) but the coefficient is not statistically significant at the 0.05 level. With that being said, this model only takes into account the collective action variables, which fails to account for institutional differences.

4.6.3 Institutional Model

Model 2 only accounts for institutional factors and control variables and its estimates are found in table 4.3. The following equation is estimated for model 2:

$$\begin{aligned} RRA_{i,t} =& \beta_0 + LogGDPpc_{i,t}\beta_1 + RR_{i,t}\beta_2 + LL_{i,t}\beta_3 + (RR_{i,t} \times LL_{i,t})\beta_4 + \\ & PostSAP_{i,t}\beta_5 + prElecSys_{i,t}\beta_6 + mixElecSys_{i,t}\beta_7 + PolComp_{i,t}\beta_8 + \\ & Presidential_{i,t}\beta_9 + ExcludePop_{i,t}\beta_{10} + \varepsilon_{i,t} \end{aligned} \tag{4.3}$$

$$i = 1, ..., N;$$

$$t = 1, ..., T$$

The model itself produces an R^2 statistic of 0.38 compared to the R^2 statistic associated with model 1. The institutional variables of interest are the electoral system, political competition, executive structure, and the excluded population. Proportional representation and mixed electoral systems are predicted to have a positive effect on the relative rate of assistance and the coefficient in the model confirms that prediction, but neither is statistically different from plurality/majoritarian

systems (the baseline category in the model). I hypothesized that the level of political competition will positively impact the relative rate of assistance, which is confirmed by the statistically significant and positive coefficient on this variable. A one unit increase in the level of political competition should produce, on average, a 4.60% increase in the relative rate of assistance. Furthermore, presidential systems are associated with lower RRA but this result is not statistically significant at the 0.05 level. Lastly, as the percentage of the excluded population increases, so too does the RRA, which I hypothesized would be the case.

4.6.4 Full Model

The full model takes both institutional and collective action variables into account along with the controls. The full model produces an R^2 statistic of 0.46, which is an improvement from both model 1 and model 2. Because it is an improvement, I am more confident in my assertion that institutions and barriers to collective action are both pertinent factors that affect distortionary pricing policies. Looking at the directions of the coefficients among the collective action indictors shows that all three display the predicted relationship (positive), but the civil society participation variable is no longer statistically significant. Among the institutional variables, the dummy variables for PR and mixed electoral system have positive and statistically significant coefficients that suggest they will have higher relative rates of assistance than plurality/majoritarian type systems. Furthermore, the political competition and excluded population have positive and significant effects on the relative rate of assistance at the 0.001 and 0.05 levels, respectively. The presidential system variable is again in the expected direction (negative) but is not statistically significant. Furthermore, the control variables of interest, namely the dummies on resource rich, landlocked, and post-structural adjustment, produce coefficients in the predicted directions and reach statistical significance. And once again, the coefficient on log of GDP-per-capita is not in the expected direction, but is also not statistically significant.

Table 4.3 Determinants of Agricultural Pricing Policy

	Model 1	Model 2	Model 3
Rural Population Density	0.113***		0.105***
	(6.68)		(4.59)
Civil Society Participation	46.89***		21.81
	(5.28)		(1.92)
Permanent Cropland (%)	-0.257		1.516***
	(-1.44)		(4.09)
ln(GDP Per Capita)	3.809	-4.698	-1.741
	(1.50)	(-1.58)	(-0.65)
Resource Rich	36.06***	26.44***	38.84***
	(7.80)	(5.98)	(7.20)
Landlocked	-7.805	-3.429	-7.225*
	(-1.54)	(-1.05)	(-2.05)
Resource Rich x Landlocked	-52.04***	-36.70***	-34.53***
	(-8.12)	(-6.87)	(-6.55)
Post-SAP Dummy	9.951*	3.954	10.17**
	(2.44)	(1.21)	(2.69)
PR electoral system		0.687	15.02**
		(0.15)	(3.18)
Mixed Electoral System		3.382	26.83***
		(0.93)	(4.12)
Political Competition		4.594***	2.322***
		(9.47)	(4.14)
Presidential System		-2.856	-12.32
		(-0.29)	(-1.43)
Excluded Population		46.68***	19.47*
		(5.87)	(2.19)
Constant	-112.1***	-22.93	-72.36***
	(-5.61)	(-0.96)	(-3.36)
Observations	339	339	339
R^2	0.35	0.38	0.46

t statistics in parentheses

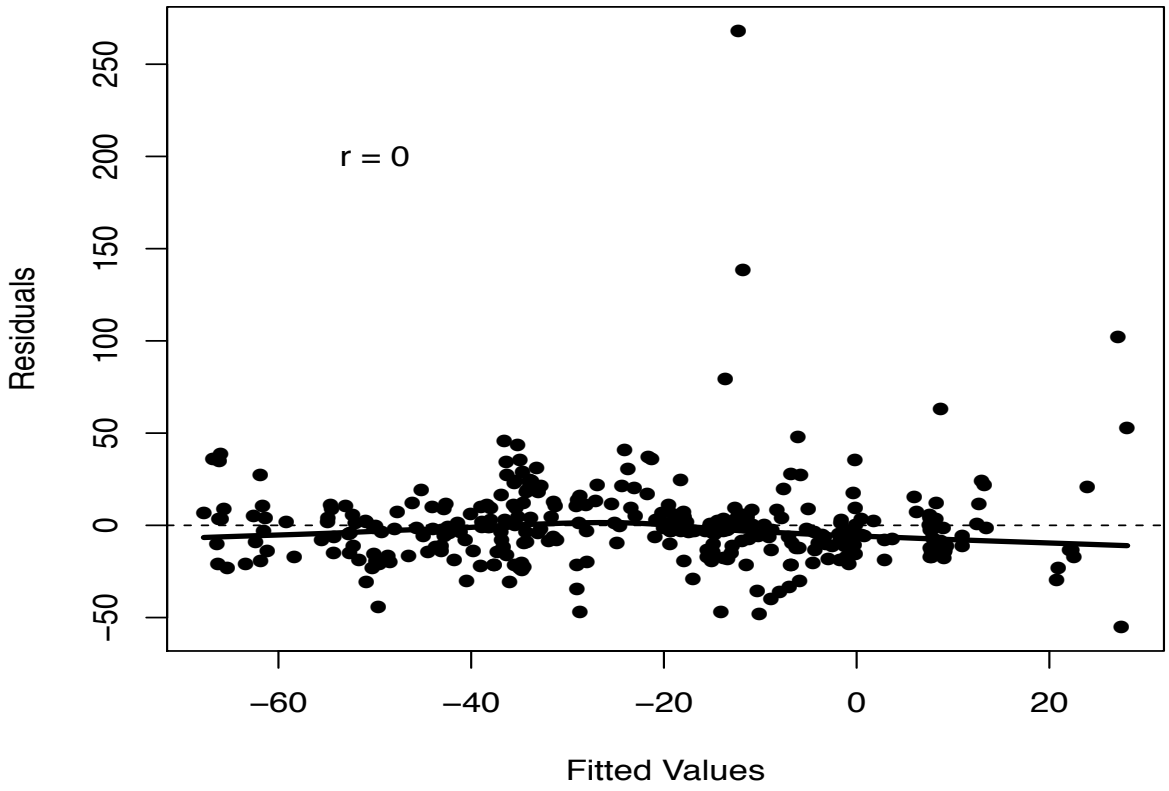
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.6.5 Overall Model Fit

As mentioned earlier in the chapter, Ethiopia appeared to contain extreme values of relative rates of assistance compared to the other values in the series. In order to test whether or not the presence of the outliers might impact the results of the model significantly, I employ some diagnostic tests. First, I calculate the studentized residuals for the full model (model 3 found in table 4.3). The studentized residuals are just a standardized version of the residuals from the model and take the following form: $E_i^* = \frac{E_i}{S_{E(-i))}\sqrt{1-h_i}}$. The studentized residuals follow a t-distribution with n-k-2 degrees of freedom, but an adjustment must be made to the p-value since the expectation is that 5% of the observations should fall into the tails given the t-distribution. With that in mind, a Bonferonni adjustment is made where $p = 2np'$. The p' is the unadjusted p-value from a textitt-test. The studentized residual for Ethiopia in 2009 is 6.05, with a Bonferroni corrected p-value less than 0.0001. Furthermore, when visually assessing the residuals from the model vs. the fitted values give by the model, it is clear that the point for Ethiopia in 2009 stands out of the crowd of points in figure 4.10. For these reasons, I estimate the model again without the offending observation and compare the estimations of models 3 and 8 in table 4.4. Figure 4.11 plots the residuals vs. the fitted values from the model without the outlier.

In table 4.4, the model used in the second column is identical to the full model estimated in model 3 from table 4.3, but without the offending outlier and produces an R^2 value of 0.57 compared to 0.46, which means this model explains over half the variance in the dependent variable. As before, the collective action variables display the expected relationship (positive), but without the outlier civil society participation is now significant at the 0.001 level. Of the institutional variables, both of the estimated coefficients for electoral systems are significant and in the positive direction, indicating that both PR and mixed systems will assist (or protect) agriculture more than plurality/majoritarian systems. The coefficient on political competition remains positive and significant at the 0.001, while the coefficient for presidential system is in the expected negative direction but remains insignificant at the 0.05 level. Lastly, among the institutional variables is the

Figure 4.10 Residual vs. Fitted Values Plot



proportion of the population excluded from holding governmental power which remains positive, but is now significant at the 0.001 level. Of the control variables, the dummy for resource rich and post-structural adjustment period remain positive and significant, while the coefficient for land-locked and the interaction between resource rich and landlocked remain negative and significant, both at the 0.001 level. The coefficient for GDP per capita remains negative, which is unexpected given my theory, but it is insignificant at the 0.05 level.

One way to visually compare the coefficients in the model is through the use of a coefficient plot utilizing rescaled variables in place of the variables in their original metric. Because the variables are all measured on different scales, it makes it difficult to compare the coefficients in the model. For instance, political competition is measured on an ordinal scale from 1 to 9 whereas excluded population is a proportion which could take on values from 0 to 1. For this reason, many of the coefficients in the model are significant but their estimates are quite small, such as rural

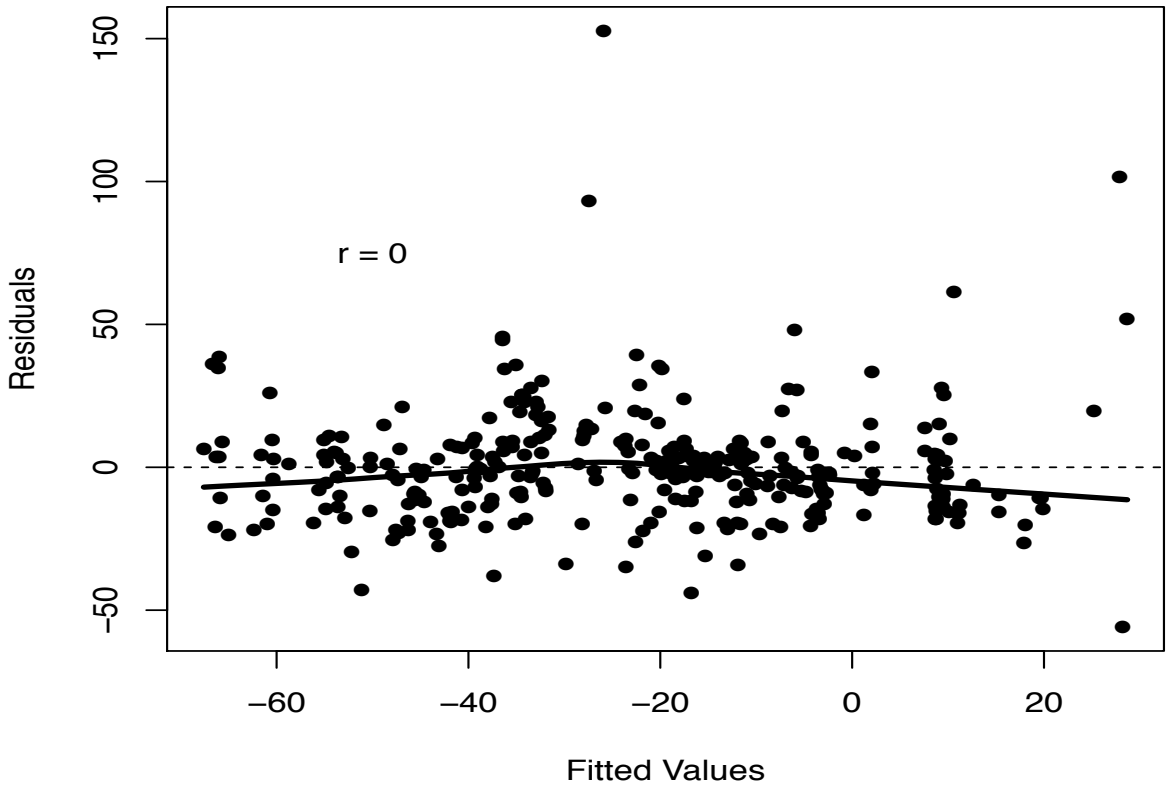
Table 4.4 Model Comparison without outlier

	Full Model with outlier	Full Model without outlier
Rural Population Density	0.105***	0.0863***
	(4.59)	(5.13)
Civil Society Participation	21.81	31.73***
	(1.92)	(4.22)
Permanent Cropland (%)	1.516***	1.321***
	(4.09)	(4.13)
ln(GDP Per Capita)	-1.741	-1.916
	(-0.65)	(-0.92)
Resource Rich	38.84***	36.69***
	(7.20)	(8.01)
Landlocked	-7.225*	-10.60***
	(-2.05)	(-4.41)
Resource Rich x Landlocked	-34.53***	-33.90***
	(-6.55)	(-6.71)
Post-SAP Dummy	10.17**	11.11**
	(2.69)	(2.93)
PR electoral system	15.02**	13.39**
	(3.18)	(3.06)
Mixed Electoral System	26.83***	23.03***
	(4.12)	(4.36)
Political Competition	2.322***	1.979***
	(4.14)	(4.15)
Presidential System	-12.32	-6.577
	(-1.43)	(-1.07)
Excluded Population	19.47*	23.34***
	(2.19)	(3.50)
Constant	-72.36***	-75.18***
	(-3.36)	(-4.30)
Observations	339	338
R^2	0.46	0.57

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 4.11 Residual vs. Fitted Values Plot



population density which has a coefficient value of 0.9 compared to a coefficient value of 31.73 for the civil society participation variable. Even thought they are both significant at the 0.001 level, their estimates are wildly different due to the differences in their measurement. Of the variables in my model, nine are measured either as 0 or 1 or measured on the interval between 0 and 1, so it would make sense to rescale the other variables to be on the same interval. One way to do this is to normalize the values between the interval (0,10) using the following equation[8]:

$$X = (b-a)\frac{X - X_{min}}{X_{max} - X_{min}} + a \tag{4.4}$$

I re-estimate the models from 4.3 using the normalized variables[9], which will only impact

[8]I choose to use the interval (0,10) because it is easier to work with when plotting the fitted values of the relative rate of assistance according to various profiles and values of the predictors.

[9]But without the outlier

the magnitude of the coefficients and their respective standard errors but z-values will remain the same, which is evident in table 4.5 comparing the original coefficients to those estimated using the normalized variables for the full model only[10]. Figures 4.12 and 4.13 show the relative impact of each variable on the dependent variable. Smaller and larger values now have more meaning relative to one another because the measurement differences are no longer driving the size of the coefficients. Figure 4.13 displays the normalized coefficients for just the full model but it should be more obvious now that rural population density has a larger positive effect on the outcome variable than all other predictors in the model. What's more, both rural population density and the civil society index have larger influence on the dependent variable than all other predictors in the model, which gives weight to my assertion that as the barriers to collective action chip away, the agricultural sector's capacity to collectively organize will increase, resulting in more pro-agricultural pricing policies.

Plots of predicted RRA values based on various profiles of the independent variables are included in figures 4.14 - 4.16. Plots of the predicted (or fitted) values allow a more thorough substantive interpretation of the significance of the effects by specifying particular values for the variables of interest while holding all other variables at some specified constant (usually the mean). For instance, figure 4.14 plots the predicted values of RRA across 20 equally spaced values of the civil society participation variable from 0 to 10 and plots separate lines and confidence intervals for low, medium, and high levels of rural population density. From this plot, it is evident that there are substantive differences across these categories. For one, as a country moves from low to high on the civil society participation index, the predicted RRA value increases as well. But if the level of rural population density is specified, it is evident that the lowest predicted RRA's and highest predicted RRA's along this index are quite different depending on which level of rural population density a country is in. For countries with low rural population density, they tend to start at very low levels of RRA (-57.68 %) so that even though an increase across the civil society participa-

[10]Estimations for the reduced models using normalized variables can be found in table A.2 in Appendix A

Table 4.5 Comparison of Original vs. Normalized Coefficients

	Full Model original values	Full Model normalized values
Rural Population Density	0.0863***	4.519***
	(5.13)	(5.13)
Civil Society Participation	31.73***	2.798***
	(4.22)	(4.22)
Permanent Cropland (%)	1.321***	1.867***
	(4.13)	(4.13)
ln(GDP Per Capita)	-1.916	-0.760
	(-0.92)	(-0.92)
Resource Rich	36.69***	3.669***
	(8.01)	(8.01)
Landlocked	-10.60***	-1.060***
	(-4.41)	(-4.41)
Resource Rich x Landlocked	-33.90***	-3.390***
	(-6.71)	(-6.71)
Post-SAP Dummy	11.11**	1.111**
	(2.93)	(2.93)
PR electoral system	13.39**	1.339**
	(3.06)	(3.06)
Mixed Electoral System	23.03***	2.303***
	(4.36)	(4.36)
Political Competition	1.979***	1.583***
	(4.15)	(4.15)
Presidential System	-6.577	-0.658
	(-1.07)	(-1.07)
Excluded Population (%)	23.34***	2.264***
	(3.50)	(3.50)
Constant	-75.18***	-73.44***
	(-4.30)	(-8.63)
Observations	338	338
R^2	0.57	0.57

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 4.12 Coefficient Plot with normalized values comparison

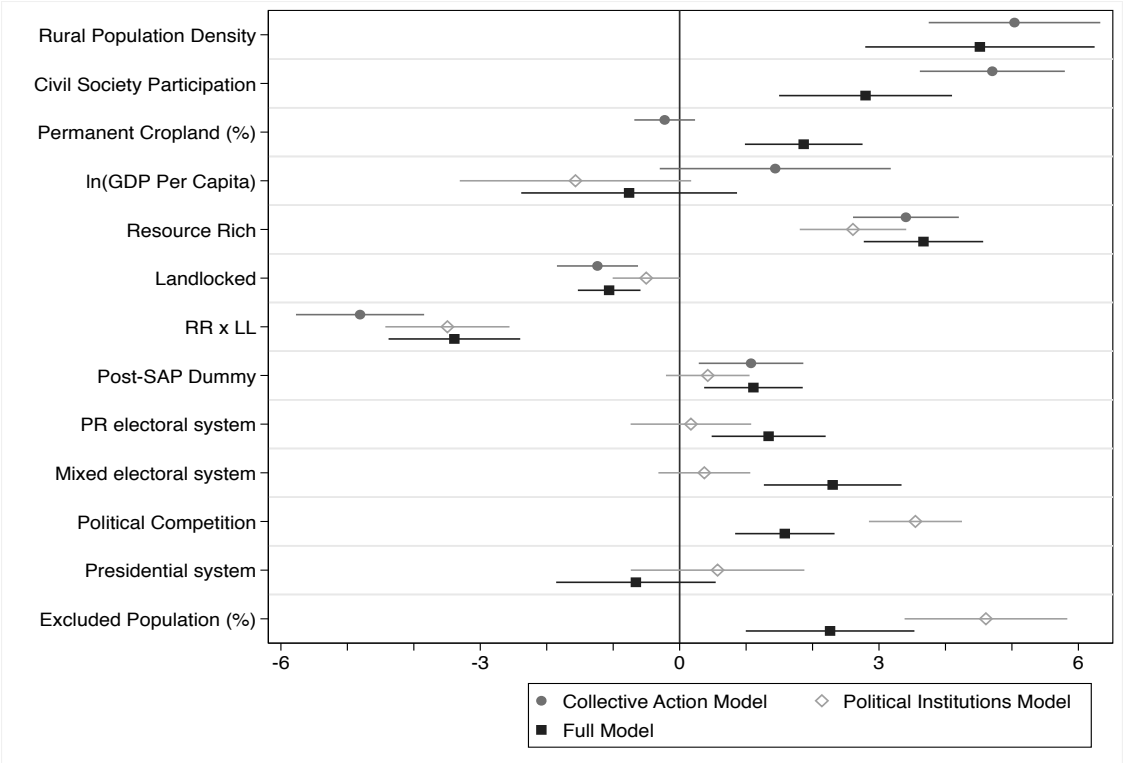
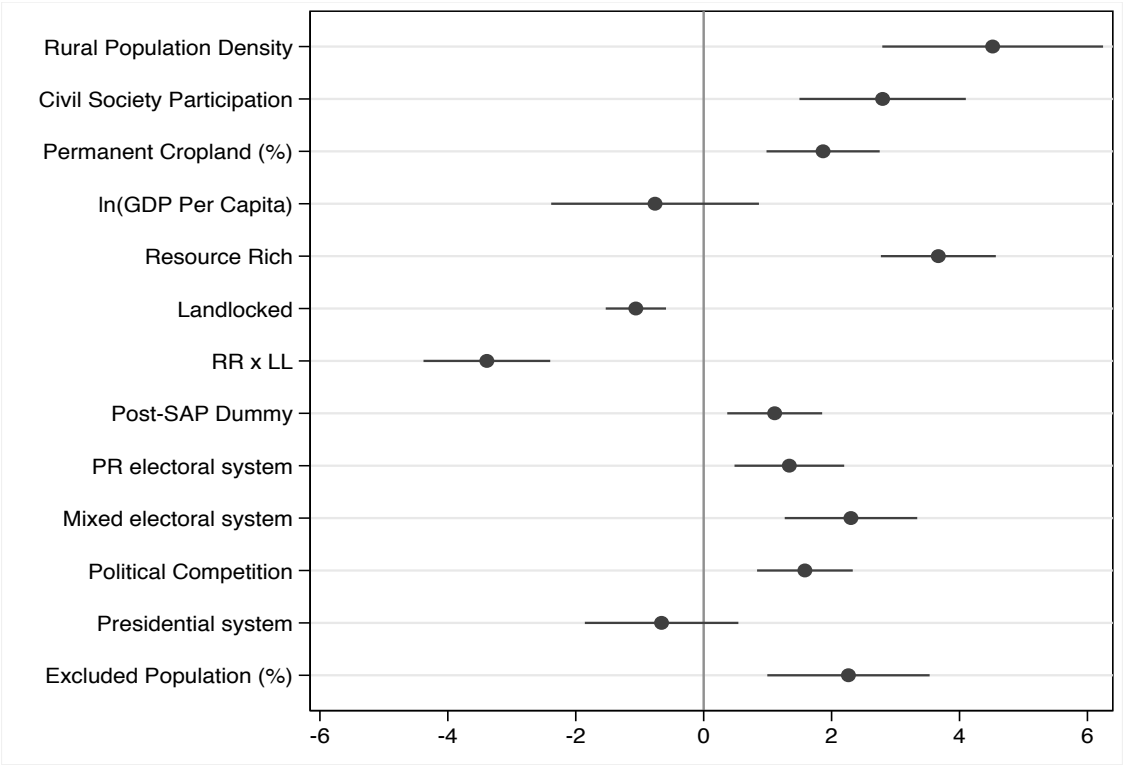


Figure 4.13 Coefficient Plot with normalized values (full model only)



tion index increases the RRA as well, low rural population density countries still end at a very low predicted value of the RRA at -29.71%. Conversely, high rural population density countries are predicted to have RRA's of -12.50% at the lowest end of the civil society participation index and reach a predicted RRA of 15.48%. That being said, the predictions of the RRA for high rural population density countries are insignificant until they reach very high levels on the civil society participation index, which should be evident from the plot whenever the confidence intervals overlap with the 0 value. For the median level of rural population density, all predicted values are significant and range from -35.10% to -7.11%.

Figure 4.14 Predicted Values of RRA across Civil Society Participation & Different Levels of Rural Population Density

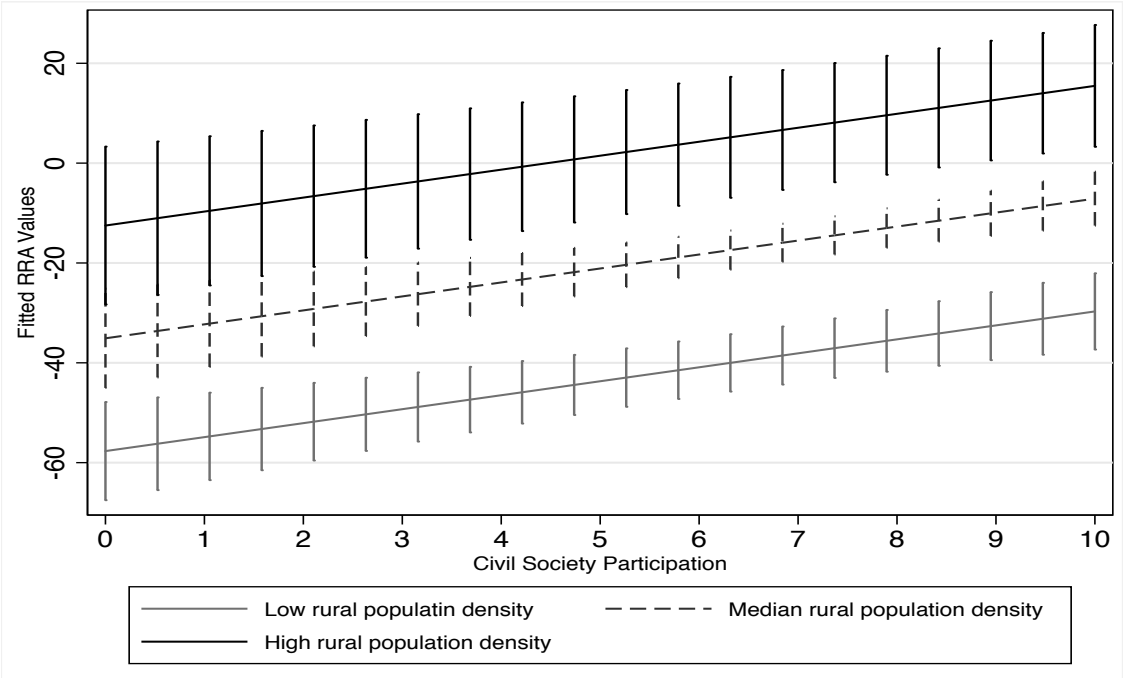


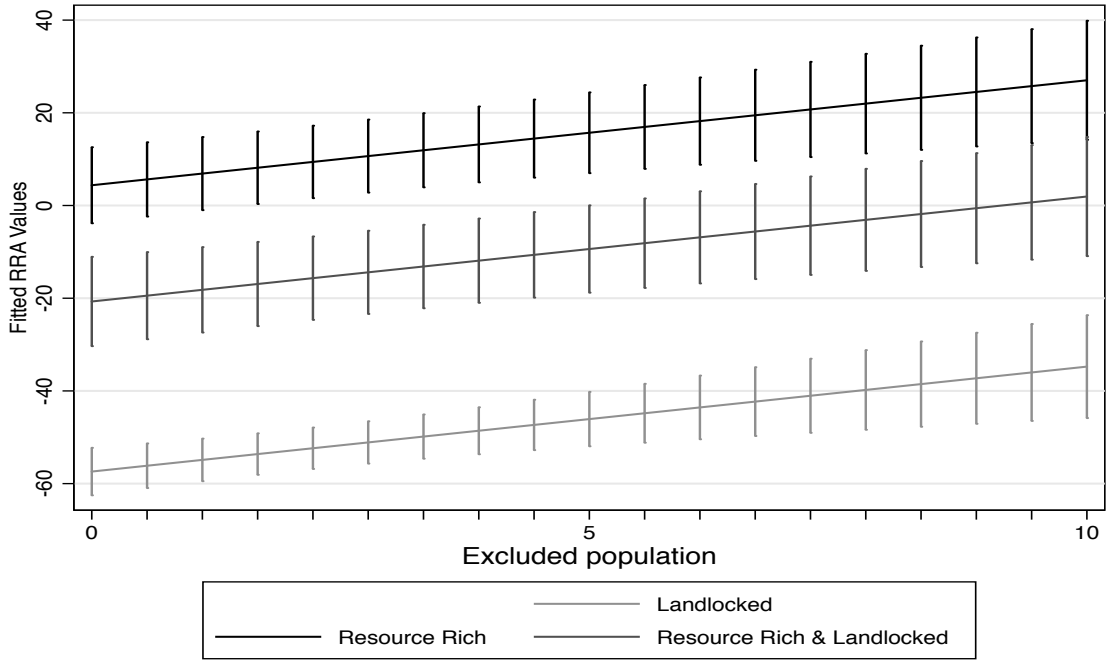
Figure 4.15 plots the predicted RRA's across equally spaced values of the excluded population variable from 0 to 10 and differentiates the between those countries that are resource rich, landlocked and those that are both resource rich and landlocked. Overall, as the excluded population increases, so too does the predictions for the relative rate of assistance, which makes intuitive sense: when there are many groups and actors included in the policy-making process, the winning set of policies will result from competition among the relevant groups, which means stronger,

better organized interests should prevail in these cases. Because agricultural interests tend to be poorly represented, it would make sense that even if the agricultural sector is more likely to have a voice given that many groups are included in the power sharing system, their voice is likely to be unheard over stronger, more organized groups. Furthermore, the confidence bands are tighter around lower values of the excluded population and wider around higher values of the excluded population. If there are fewer people involved in the political process, either because they are institutionally kept out of the process or just lack power due to things like electoral outcomes, it should be less clear, in this particular model, whether or not the agricultural sector will benefit from the groups in power in this instance. It might be the case that the small minority that is in power is also interested in policies that would protect the agricultural sector, but I cannot know that for sure from this particular variable. Therefore, when more people are included in the process, it is more likely that agricultural interests will be represented but they will also have to compete with groups that are likely more organized than themselves. And further, as the number of people excluded increases, it becomes more difficult to predict relative rates of assistance with confidence because it is unclear whether that small minority of people also favors protective policies for agriculture, which introduces an element of randomness that is not accounted for in the model. Even if this means the agricultural sector will have more access to power through this increase in representation, the larger coalitions that must be built might favor more agricultural policies on the side of public goods provision like research and development spending and/or spending on roads in the countryside (Collier 2007).

The plot further differentiates between resource rich countries and landlocked countries with predictions for the interaction between resource rich and landlocked. For landlocked countries, whether or not they are also considered resource rich will have a large impact on their predicted rates of assistance. For landlocked countries that are not resource rich, the predicted RRA values range from -57.40% to -34.76% across low to high levels of excluded population, which indicates that landlocked, resource countries will tend to have very low rates of assistance. Conversely, landlocked countries that are also resource rich produce predicted RRA's of -20.71% to 1.93%, but

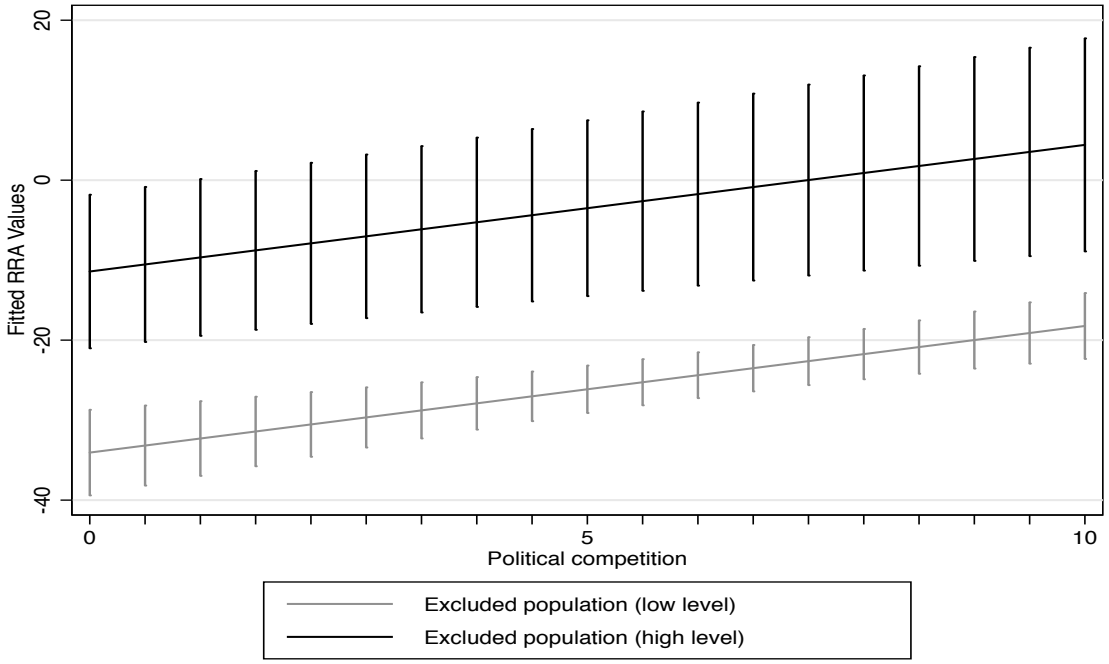
the predicted values are only significant up until about the midpoint along the excluded population values. This indicates that once the excluded population reaches around half or more of the population, it becomes more difficult to predict levels of assistance in those countries. For countries that are not landlocked, but are resource rich the predictions are consistently above 0, but only significant at low levels of exclusion. This also makes a lot of sense given the characteristics that tend to be associated with resource rich countries. If a resource rich country excludes many groups and people from the political process, there are more opportunities for very few people to extract rents without redistributing the benefits, which means that these countries may still need to extract rents from the agricultural sector simultaneously. One argument for why these types of countries will be more unpredictable probably has a lot to do with the *types* of natural resources the countries possess. Countries with certain types of resources tend to be extractive and less likely to redistribute for the betterment of the country. They can also be more prone to intra-state conflict, which also makes it more difficult to predict these country's policy choices given that this will introduce some randomness that is not accounted for in the model.

Figure 4.15 Predicted Values of RRA for resource rich vs. landlocked across excluded population



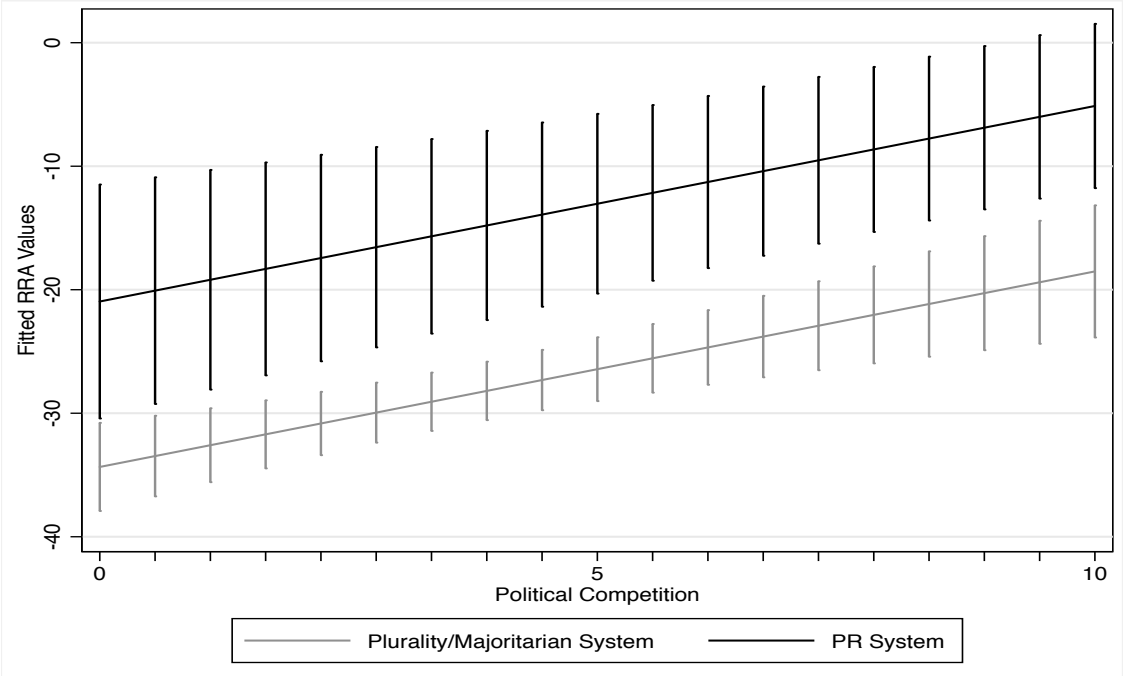
Political competition should impact the types of policies that governments undertake, and more specifically, many studies find that political competition has a positive impact on the level of assistance that is given to the agricultural sector in both developing and developed countries (Bates and Block 2011; Stasavage 2005). The predicted RRA values seem to demonstrate this across values of political competition: as political competition increases, so to do the predicted RRA values from -30.50% on the low end of political competition to -14.67% on the higher end holding all other variables at their means. If I differentiate between those observations that have low levels of excluded population (high inclusion rates) and high levels of excluded population (low inclusion rates), the effect is more pronounced for those at the low level of exclusion and predicted values range from -34.06% to -18.23% which shows that even though countries with low exclusion rates may experience lower than average RRA's, political competition can mitigate this somewhat. As the electoral system becomes more competitive, political actors and groups will have no choice but to recognize those interests with the largest numbers and the agricultural sector is one that is particularly large.

Figure 4.16 Predicted values of RRA by high and low levels of excluded population across values of political competition



The electoral system should also be taken into account when assessing how political competition might impact policy choices. In figure 4.17, it is clear that PR electoral systems protect agriculture more than plurality systems across all levels of political competition. Only at the very highest levels of political competition is the PR electoral system no longer significant, but across all other values, the difference is significant between the two electoral systems holding all other variables at their mean.

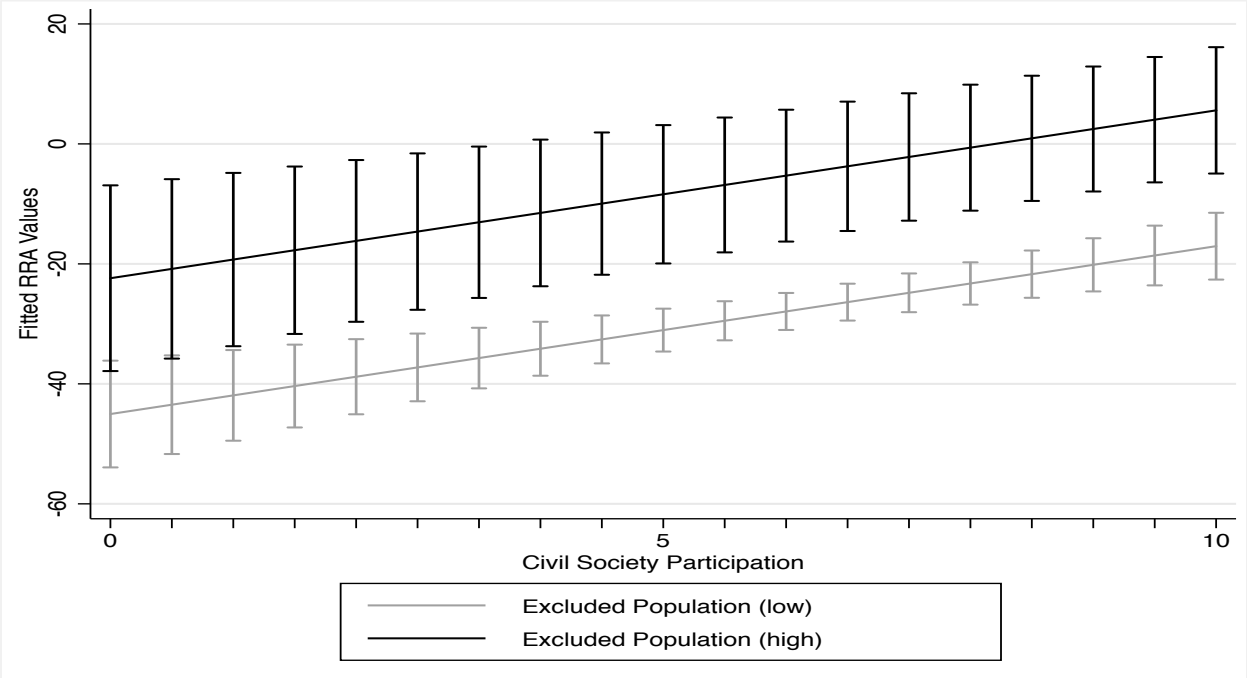
Figure 4.17 Predicted values of RRA by plurality and PR electoral systems across values of political competition



Environments that encourage more civil society participation should see more favorable agricultural policies than those that have do not have very inclusive civil society environments, but whether or not those groups have any representation in government will also impact their ability to influence tangible policies. In situations where most ethnic groups are represented in government (exclusion is low) and civil society participation is also low, the relative rate of assistance will be around -45%. But as civil society participation increases along the index, so too will the relative rate of assistance while holding the rate of exclusion constant (at the low level). This means that policies will be less "anti-agriculture" in nature when constituents have representatives that share

their ethnicity and they have an institutional environment that is conducive to direct participation through organized groups. The same is true for those at the high level of exclusion (fewer ethnic groups represented in government), albeit at a higher rate. When a large proportion of the population is excluded from power and the civil society participation score is 0, then the RRA is predicted to be about -22.4%. However, when the civil society participation score increases to about 3.33, the RRA is predicted to be about -13.1%. After this civil society participation score, the predicted values are no longer significant in the high exclusion category.

Figure 4.18 Predicted values of RRA by high and low levels of excluded population across values of civil society participation



4.7 Conclusion

In conclusion, the analysis here provides support for hypotheses on the factors that influence agricultural pricing policies. First, the analysis provides support for the general theory that environments which are more favorable to collective action and mobilization will produce policies that are more pro-agriculture observed by their greater relative rates of assistance. Countries with rural

populations that are less dispersed should see higher relative rates of assistance because proximity to others with similar policy interests decreases some of the costs of organizing. Similarly, when civil society organizations exist in an environment that encourages their participation, it is more likely that agriculture will benefit from this relative to other sectors. Not only that, but if the agricultural sector itself is made up of many individuals that face a greater incentive to lobby for particular policies (those with more specific assets), then it is more likely that policies will be more protective of the agricultural sector through pricing policies.

Secondly, the analysis provides support for my second set of hypotheses about political institutions. When the political stakes are high, it will be more likely that those in power will prefer to assist the agricultural sector through more price supports. Electoral system design and political competition shape the incentives and subsequent behaviors of officeholders. Proportional representation and mixed electoral systems produce electoral incentives that tend to produce more protectionist policies for agriculture compared to plurality/majority systems. Also, the more competitive it is to win seats in government, the more likely that pricing policies will be more favorable for agriculture than when there is very little political competition.

CHAPTER 5

THE DETERMINANTS OF AGRICULTURAL RESEARCH AND DEVELOPMENT SPENDING IN SUB-SAHARAN AFRICA

5.1 Introduction

Within Africa, government spending on agricultural research and development remains low, extractive pricing policies persist, and yet rural constituents tend to support incumbents more often than their urban counterparts. Recent research has analyzed agricultural policy by looking at government intervention via price distortions. Less research has looked at the determinants of government spending on research and development within Africa. Robert Bates has defined agricultural policy as "government actions that affect the incomes of rural producers by influencing the prices these producers confront in the major markets which determine their incomes" (1981, 3). I conceptualize agricultural policy differently in that I also consider government inputs that would influence production, and included in those inputs is agricultural research and development spending. Therefore, I analyze spending data and argue that low spending is due to the nature of agricultural research: it acts like a public good, it is politically risky to undertake, and the benefits accrued to farmers are difficult to link to a specific political actor. Coupled with the long-term nature of agricultural research spending and the threat of losing office, politicians will pursue other short term and more tangible benefits to distribute to farmers around election time. I also argue that this persists because collective action among farmers is necessary to influence policy and politicians are aware that the costs of organizing are high for these heterogeneous and highly dispersed groups.

5.2 Agricultural Policy via Research and Development Spending

Outside of price supports, another instrument used to support agriculture is through government expenditures, or public spending on agriculture. Within Africa, about half of African countries reduced agricultural expenditure relative to their agricultural GDP (Fan and Saurkar 2006). Within

Sub-Saharan Africa, agricultural research and development spending levels have lagged in comparison to other developing regions. Spending patterns are the most visible indication of a government's priorities and although the rates of return to public spending on agricultural R&D are high, the spending priority remains low (Jacoby and Schneider 2001; Evenson 2001; Jacoby and Schneider 2009; Alston et al. 2010). Many studies have shown a link between government spending and agricultural growth (Elias 1985; Fan, Hazell and Thorat 2000; Fan, Zhang and Zhang 2004). Furthermore, studies have continually shown that the rate of returns to input subsidies, such as fertilizer, started to fall in the 1980's while returns to agricultural research and development continue to rise into the present (Chand 2000). More specifically, agricultural research and development spending as a percentage of agricultural GDP is shown to be most important for agricultural growth (Fan and Saurkar 2006, 14).

5.2.1 Data Selection: Agricultural Research and Development Spending

The dependent variable of interest is public expenditures on agricultural R&D provided by the Agricultural Science and Technology Indicators (ASTI) database administered by the International Food Policy Research Institute (IFPRI). The way that ASTI derives its data is through surveys that are administered to all agencies involved in agricultural research and development for each country surveyed. The data on spending levels relies on estimates of salaries, operational costs and capital costs. The data consists of measures for 13 countries within sub-Saharan Africa from 1980-2009. In total, there are 285 observations on the dependent variable and it is measured in constant (2011) US dollars. Summary statistics for each country on this particular measure are provided in table 5.1. The overall mean is 65.41 (million 2011 U.S. dollars) and the country specific time series are found in figure 5.1.

Figure 5.1 Agricultural Research & Development Spending by Country

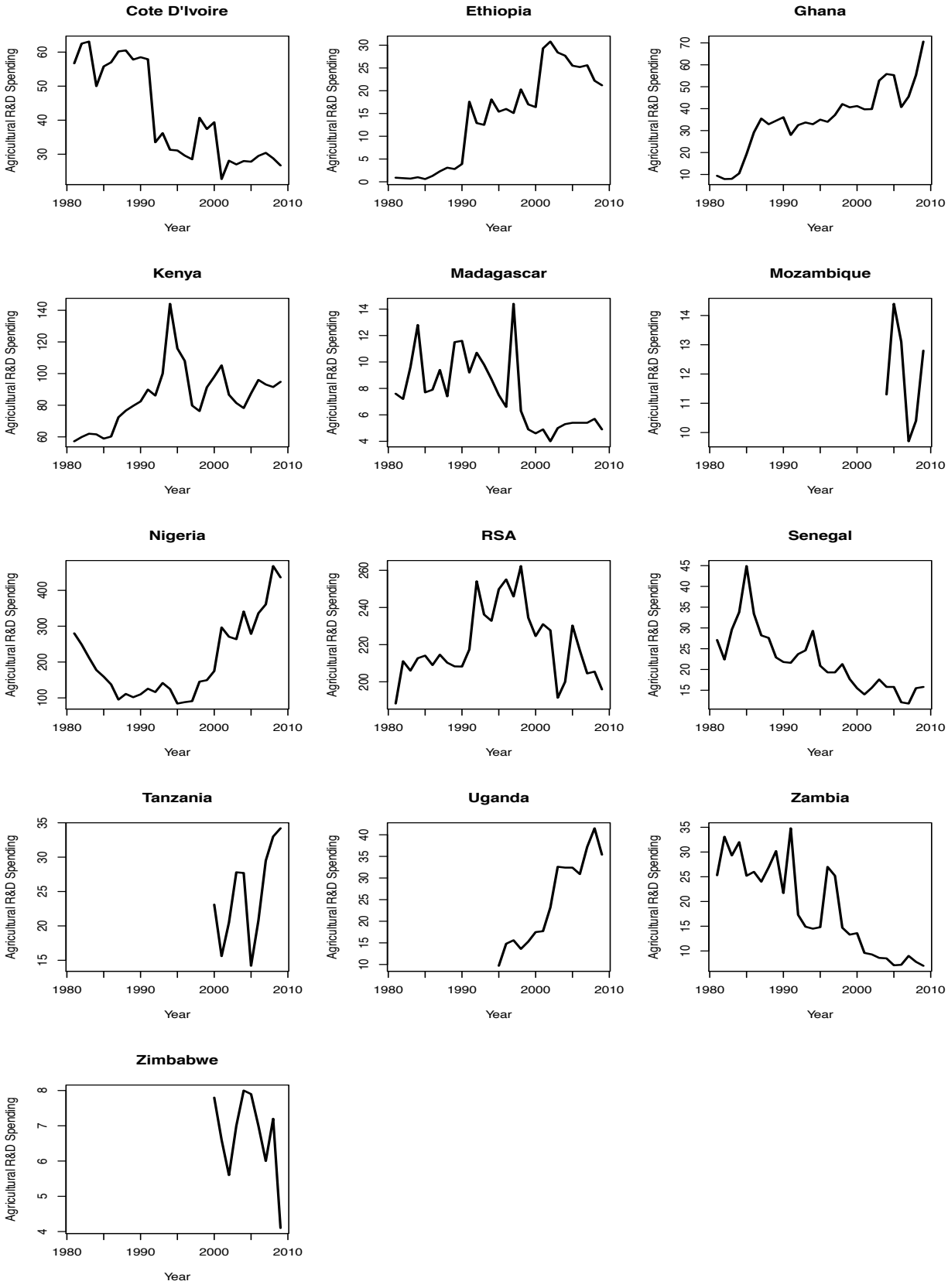


Table 5.1 Summary Statistics: Agricultural R&D Spending (2011 US$) across countries

Country	N	Mean	S.D.	Minimum	Maximum
Cote d'Ivoire	21	45.67	14.12	22.70	63.10
Ethiopia	25	14.23	11.20	0.60	30.80
Ghana	28	35.84	15.15	7.90	70.60
Kenya	29	85.33	19.25	57.20	144.10
Madagascar	28	7.53	2.70	4.00	14.40
Mozambique	6	11.95	1.79	9.70	14.40
Nigeria	28	206.30	110.55	84.20	467.80
Senegal	27	219.61	20.01	188.30	262.30
South Africa	29	22.03	7.49	11.80	44.90
Tanzania	10	24.64	6.91	14.20	34.20
Uganda	15	24.65	10.33	9.70	41.50
Zambia	29	18.55	9.17	7.00	34.80
Zimbabwe	10	6.72	1.21	4.10	8.00
Total	285	65.41	83.56	0.60	467.80

5.2.2 Agricultural R&D Spending: A Public Good

Within SSA, governments tend to underinvest in agricultural R&D. Part of the explanation for this trend may be due to the "public goods nature" of agricultural R&D. By definition, a public good is non-excludable and non-rivalrous, meaning that once it is provided no one person can be excluded from using it and that use does not diminish the benefits/amount that is available to others. Kaul and Mendoza (2003) argue that many goods have become mixed-cases; they display a mixture of public and private goods characteristics. Agricultural research and development (R&D) is not exclusively a private or a public good; it displays characteristics of both. The private provision of these types of goods are not always feasible and often governments will step in to provide for goods that are not attractive to the private sector, largely because they will fail to produce a profit. When the government decides to provide for these goods, the motivations underlying this decisions are often for self-interested reasons, some of which result in rent-seeking behavior. Because of this, there are particular incentives and constraints that need to be taken into account when looking at the factors that influence policy decisions over the provision of public goods.

5.3 Determinants of Agricultural R&D Spending: Institutions

Some institutional designs are more conducive to the production of public goods through official governmental policy. The institutional environment will structure the interactions between decision makers and the people or groups whose lives are impacted by those decisions. Institutions that lower transactions costs are often most effective when collective action is necessary to provide public goods. Therefore, it is important to parse out the particular institutions that tend to incentivize or produce particular kinds of relationships and behaviors between and among the relevant actors.

5.3.1 Electoral System and Electoral Competition

As stated above, agricultural R&D spending tends to display a variety of characteristics associated with public goods. One characteristic that may deter increases in agricultural R&D spending is the lack of attribution quality, that is the difficulty with which credit is attributed to specific policy-makers. Operating under the assumption that elected officials are rational and are motivated by staying in power via winning re-election, then the strategies of these particular actors will depend on the ways in which they are elected. Some electoral systems seem to incentivize more candidate-centered approaches which rely on the candidate's ability to "stand out" to voters in particular ways usually through a process where electoral promises are made and the candidates are evaluated on how well they can "deliver the goods" so to speak(Cox 2001). In this sense, institutions that reward more candidate-centered politics might be less inclined to push for public goods policies because of the diminished ability to credit-claim in these situations.

Candidate-centered electoral systems are typically associated with plurality or majoritarian rules where the winner of the public office is the person who won the most (or majority) of the votes. Because the incentive is to win as many votes as possible, their strategies will reflect this notion. Motivations to retain office in plurality/majority type systems necessitate that candidates are able to appease a larger number of people than is necessary in more proportional electoral

systems. Politicians might do this either by supplying targeted benefits to voters around election time through very particularized benefits via earmarks for special projects or through the use of public policies to supply private benefits to a subsection of the population through something like subsidies (this tendency is also called rent-seeking) (van de Walle 2001). The nature of this rent-seeking behavior will, in large part, depend on the type of rents that can be extracted. Conversely, proportional representation systems (and systems that include a mix of plurality and proportional elements), tend to reward party-centered politics more than candidate-centered politics.
Therefore, I hypothesize the following about electoral systems[1]:

Hypothesis 5.1 *Countries with proportional electoral systems will spend more on agricultural R&D than countries with plurality electoral systems.*

Furthermore, the level of political competition within any one electoral system may exacerbate some of the characteristics of candidate-centered politics. In order to differentiate themselves from one another, candidates will have to convince voters why they should choose them specifically rather choosing an overall policy ideal that some candidates' parties may prescribe to. In this sense, promoting policies that are more easily targetable toward supporters may be the winning strategy compared to efforts to supply more public-regarded policies. Thus political competition might incentivize more clientelistic transfers through subsidies instead of increased investments in public goods like research and development spending (Poulton 2014). Given these arguments, I hypothesize the following regarding political competition and agricultural R&D spending:

[1] I did not end up including this particular variable in models 2 or 3 in table 5.3. In the full model found in B.3 in Appendix B, the coefficient on the dummy variable for proportional representation and mixed electoral systems is insignificant at the 0.05 level and in fact, have very low z-values. To formally test the joint significance of the two variables, I perform a Wald test which is robust to the presence of autocorrelation and heteroskedastic errors. Because the panel corrected standard errors automatically assume heteroskedasticity in the errors, the standard F-test is not appropriate in this case as it assumes homoskedastic and uncorrelated errors when estimating the F-statistic. The Wald statistic is 0.77, which is lower than the critical chi-square value of 5.99 at the 95% confidence level. For this reason, I prefer the more parsimonious model that does not include estimates for the electoral systems in place for each country.

Hypothesis 5.2 *As political competition increases (decreases) within a country, spending on agricultural R&D will decrease (increase).*

5.3.2 Tenure in Office

There is also a large lag associated with returns to agricultural R&D; the returns to the investment may not be realized until the responsible policy-makers have already left office. This characteristic makes agricultural R&D spending unattractive to politicians concerned with voter loyalty and reelection. Price distortions and subsidies have a quicker return and are also more conducive to rent-seeking behavior. Agricultural R&D cannot be manipulated as easily as something like fertilizer subsidies, which can be targeted at specific groups within the rural population. Tangible investments, such as input subsidies, are easier to connect back to the spending decisions of policy-makers (Keefer and Khemani 2003). For agricultural growth and poverty reduction, public investment in agricultural R&D produces much higher returns than spending on agricultural subsidies, but the electoral incentives may not exist in some institutional settings. Public offices that have tenure limits and/or re-election limits will further amplify the need to accomplish particular goals in a specified period of time. There is also evidence to suggest that leadership tenure affects the amount of extractive policies pursued, with longer tenure associated with less extraction. Therefore, I expect that tenure in office will have a marked impact on the decision to redirect more spending toward agricultural R&D. Although electoral turnover is rare in SSA, the threat of turnover is not necessarily absent, therefore politicians may be less inclined to support public R&D spending when their electoral future is unknown. Furthermore, the time dimension to public goods policies has an impact on the credible commitment that particular political actors can make to public policies that require long-term investments: the shorter the term of office, the more likely politicians will choose short-term measures.

Hypothesis 5.3 *As the tenure in office of the executive increases, the more a country will spend on agricultural R&D.*

5.4 Determinants of Agricultural R&D Spending: Collective Action

5.4.1 Ethnic Group Representation

Heterogeneous ethnic communities make it difficult to coordinate. With a large number of ethnic groups come coordination problems. Research has shown that public goods provision tends to be lower in countries with a high level of ethnic heterogeneity. Because the agricultural sector in particular relies on many of these public goods, like paved roads and irrigation systems, having a more heterogeneous ethnic make-up may be worse for farmers in those countries. Because ethnic groups behave much like interest groups, then these ethnic groups will try to secure goods for their members much like an interest group would secure benefits for their members. In some countries, one particular ethnic group is dominant and holds a majority of governmental power to the detriment of any and all others. In this scenario, it is less likely that the government will choose to provide for public goods over more excludable goods. In other countries, the government is more inclusive, which means more people are represented in government. Findings within the selectorate theory literature form the basis for this argument. Selectorate theory posits that governmental policies are a result of the make-up of two groups in the population: the selectorate (S) and the winning coalition (W) (de Mesquita et al. 2003). The selectorate is made up of those individuals who are able to participate in the selection of the leader(s). The winning coalition is made up of the population whose votes were translated into seats for public office (voters who supported the subsequent winners in an election). When W makes up a large portion of S, rational politicians will be more likely to supply public goods over more excludable goods. This establishes a more top-down argument for how more inclusive governments might result in a greater provision of public goods.

Conversely, public goods might be provided through a more bottom up mechanism. When a larger proportion of the population is represented in government, this might contribute to one type of social capital that is said to help the poor in particular: linking social capital. When certain groups lack representation in government, they also lack ties to those in power who are responsible

for policies. When this happens, individuals are more likely to cooperate within their own ethnic group in order to provide for particular goods locally if the state refuses to provide them. Therefore, they are less likely to perceive the government as the main apparatus through which certain public goods unless of course their own ethnic group successfully captures some amount of governmental power. This also means they are less likely to interact with other ethnic groups and will very likely perceive outsiders as their competition for valuable resources. For this reason, maize farmers in one region, from one particular ethnic group will be less likely to coordinate and cooperate with maize farmers from other regions and ethnic groups, even if it would benefit them to do so. If more individuals from different ethnic groups are forced to interact with one another in government, they might be more likely to see the similarities that exist between their respective voters' preferences and more likely to cooperate with one another to provide for public goods that are mutually beneficial. As Collier (2007) argues: "ethnically diverse democracies may be messy, but they do force the coalition in power to be large" (p. 17). Because of this, larger coalitions might prefer policies oriented toward public goods rather than those that redistribute to only a privileged few.

For this reason, I expect a high level of governmental exclusion will have a negative impact on the level of agricultural R&D spending. I expect this relationship for a few reasons. First, because agricultural R&D spending has public goods' characteristics, it will be difficult to target the benefits of the spending to particular groups or individuals. When there are fewer people or groups in control of governmental spending, it is more likely that the spending will not go toward more public-regarded endeavors like research and development. If ethnic groups behave like interest groups and very few groups have access to power, then it is unlikely that these groups will favor research and development spending when the benefits are not very visible or targetable. In this sense, one group or a small number of groups might prefer not to provide the good at all if it is not clear which groups will benefit from its supply. As the number of groups that have access to power increases, the more likely that winning strategy is to provide more public goods. Furthermore, if the mechanism is bottom-up, having more links to those in power increases

the responsiveness to a larger group of individuals and hence, incentivizes farmers from different regions and ethnic groups to cooperate with on another to demand more growth enhancing policies. In either scenario, more inclusive governments should provide more public goods, which leads me to the following hypothesis:

Hypothesis 5.4 *As the excluded population increases (decreases) in a country, the less (more) it will spend on agricultural R&D.*

5.4.2 Group Size and Proximity

Group size and dispersion is an important factor discussed within the collective action literature because the size of the group introduces costs to coordination among individuals in a group. When the group size is very large, it becomes more difficult for group members to coordinate for their own benefit. Not only that, but even if they can manage to overcome coordination issues and organize themselves to lobby for certain policies, larger groups will experience a diminishing return as the group size increases. The return conferred to larger groups must be divided among many more individuals than smaller groups. This means that larger groups must work harder to overcome coordination problems in order to receive benefits that must be divided among a greater number of individuals resulting in a lower return per person. Either the benefit must be very large or the costs associated with organization must be very low in countries that have a very large agricultural sector.

One assumption related to this is the assumption that groups know what benefits they will accrue *ex ante*, which may not be a reasonable assumption to make especially when it comes to something like agricultural R&D spending. Smallholder farmers will usually be more at a disadvantage than larger farms in this area (Mogues 2015). Countries that have very dispersed rural populations tend to be made up of smallholder farms. So for these countries, the agricultural sector is at a supreme disadvantage because the costs of organizing *and* the informational costs are high.

Finally, the dispersion of the rural sector also impacts whether or not any spillover effects may occur. Agricultural R&D activities can be relatively location-specific due to the geographic and climactic specificity of some agricultural products. Agricultural R&D activities also tend to be characterized by various spillovers, whereby neighboring groups, farms, regions, etc. will benefit from the outputs produced by those activities regardless of whether or not they were specifically targeted to those entities (Benin et al. 2009). Because of this tendency, it might be more cost-effective for the state to spend more on agricultural R&D in situations where those spillover effects will benefit more individuals because of the proximity of farms and groups. Taking all of these factors together, I hypothesize the following about the size and dispersion of the rural population:

Hypothesis 5.5 *As rural population density increases (decreases) within a country, the more (less) it will spend on agricultural R&D.*

5.4.3 Asset Specificity

Industries with very specific assets tend to be more likely to lobby for their interests (Alt et al. 1996, 1999; Zahariadis 2001). The agricultural sector, in general, tends to be associated with more specific assets than other sectors. Asset specificity can be differentiated by type: site, physical, human and dedicated asset specificity. Industries with a high level of site specificity are characterized by immobility: once the assets are on site, they very difficult to move to other sites for some other use. Human asset specificity refers to the individual expertise of the people involved in that particular industry; if the industry is very knowledge intensive and highly complex, then that industry has high human specificity. Physical asset specificity refers to the situation where the equipment used in the production of the good is very expensive, complex, and/or specialized and cannot be used for many different purposes. And lastly, dedicated asset specificity refers to investments in particular assets that would not otherwise have been made had there not been a contractual agreement between the supplier and a buyer for a specified sale. The production of certain agricultural goods might be associated with high levels of all, some or relatively none of these types of asset

specificity, but in general, agriculture tends to be associated with a high level of asset specificity.

Because it is difficult to move assets to other uses when they are highly specific, then it should be more likely that farmers who find themselves in this situation should have greater incentives to secure favorable policies for their particular industry. Annual crops tends to be associated with less asset specificity than tree crops, which occupy the land for long periods of time. Because of this I use the percentage of permanent cropland in each country as a proxy of asset specificity, which leads me to the following hypothesis:

Hypothesis 5.6 *As the percentage of permanent cropland increases (decreases) within a country, the more (less) it will spend on agricultural R&D.*

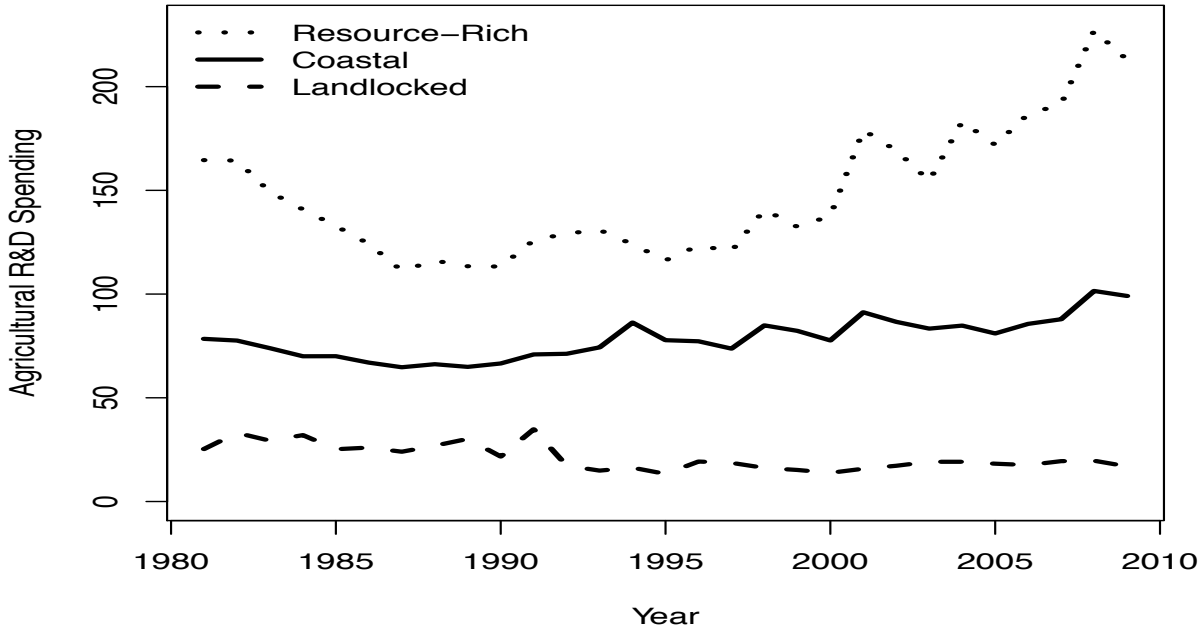
5.5 Control Variables

5.5.1 Resource Endowments and Geography

Collier (2007) found that both differences in natural resource endowments and physical geography are linked to various development paths across sub-Saharan Africa. More specifically, when it comes to resource rich countries, the public sector is usually larger in order to effectively tax and spend the money generated from resource rents (Collier 2007). Because of this, these particular countries may be more likely to accept a larger role in public spending and therefore, will be more likely than resource scarce countries to use revenue for public services like agricultural research and development spending. Looking at figure 5.2 it is clear that resource rich countries spend the most on agricultural R&D consistently between 1981 and 2009. Of the countries in my sample, Nigeria, South Africa and Zambia fall into this category.

Landlocked countries, on the other hand, might be more likely to rely on the "spillover" effects that are common with neighboring countries and public services/goods like agricultural R&D. Spillover occurs when the benefits paid for and supplied by one entity (a country), spillover into other neighboring entities (neighboring countries) without the second set of entities contributing

Figure 5.2 Agricultural R&D Spending by Resource Rich and Landlocked



to the cost or development of those benefits/goods. This can impact how landlocked countries approach investments in agricultural R&D in two ways: 1) they might try to exploit this tendency and hope that other countries' investments will spillover into their own country, thereby diminishing their own spending on such goods/services, or 2) they will prefer not to spend very much on agricultural R&D because it might run the risk of spillovers into other neighboring countries who could then benefit and compete with their own country. Looking again at figure 5.2, landlocked, resource-scarce countries are the lowest categories and have stayed very consistent over time in their levels of spending on agricultural research and development. The countries that fall into this category are Ethiopia[2], Uganda and Zimbabwe. All other countries are coastal and resource scarce[3]. Taking both characteristics about natural resource endowments and physical geography, I hypothesize the following:

[2]Ethiopia is considered landlocked starting in 1994.

[3]Cote d'Ivoire, Ethiopia (1981-1993), Ghana, Kenya, Madagascar, Mozambique, Senegal, and Tanzania

Hypothesis 5.7.a *Resource rich countries will spend more on agricultural R&D than resource scarce countries.*

Hypothesis 5.7.b *Landlocked countries will spend less on agricultural R&D than coastal countries.*

5.5.2 Economic Development

Not surprisingly, the amount of revenue directed at agricultural R&D spending should also somewhat depend on the pot from which it comes. Less developed countries will have less of a budget to begin with and therefore, less capacity to spend in general. Therefore, I expect that there is a positive relationship between GDP per capita and agricultural R&D spending.

Hypothesis 5.8 *As GDP per capita increases (decreases) within a country, the more (less) it will spend on agricultural R&D.*

5.6 Hypotheses and Model Choice

Table 5.2 summarizes all of the hypotheses there were specific in sections 5.3-5.5. What follows in the subsequent sections is a discussion of the analyses and the results.

The data availability allows me to administer a time-series cross-sectional study of agricultural research and development across 13 countries from 1981-2009. The unit of analysis is the country-year and summary statistics are provided in table 5.1. The country with the fewest number of observations is Mozambique with only 6 observations on the dependent variable. Twenty-nine is the maximum number of observations and three countries reach the maximum number, but the average number of observations is 21.3. Because the number of years varies across panels, the data is considered to be unbalanced. Not only that, but the time-varying, cross-unit components to the data make for more complex error structures than standard OLS estimates. This is because the

Table 5.2 Hypotheses: Determinants of Agricultural R&D Spending

Variable	Directional Test
Rural Population Density	(+)
Civil Society Participation	(+)
Permanent Cropland	(+)
ln(GDP per capita)	(+)
Resource Rich	(+)
Landlocked	(-)
Political Competition	(-)
Executive Tenure	(+)
Presidential System	(-)
Excluded Population	(-)

units are correlated across space and over time, which means that standard OLS estimates will be biased toward zero. This makes for inefficient estimates

5.6.1 Model Specification

One issue that often plagues times series cross-section models is the issue related to heteroskedastic errors and serial correlation in the errors, which might produce overconfident (artificially small) standard errors even if the coefficient estimates are unbiased (Beck and Katz 1995). Because of this, I utilize a pooled OLS model with panel corrected standard errors, which is represented by the following ordinary least squares equation:

$$\begin{aligned} y_{i,t} &= \beta_0 + x_{i,t}\beta + \varepsilon_{i,t}; \\ i &= 1,...,N; \\ t &= 1,...,T \end{aligned} \tag{5.1}$$

In the normal OLS model, the sampling variability is given by the following:

$$Cov(\hat{\beta}) = (\mathbf{X}^T\mathbf{X})^{-1}\left\{\mathbf{X}^T\Omega\mathbf{X}\right\}(\mathbf{X}^T\mathbf{X})^{-1} \tag{5.2}$$

Where the OLS standard errors are given by the the square root of the diagonal: $\widehat{\sigma^2}(\mathbf{X}^T\mathbf{X})^{-1}$.

In the presence of serial correlation and panel heteroskedastic errors, panel correct standard errors are estimated with the following distributional characteristics.: $\varepsilon\ N(0,\Omega_{NT})$. The variance-covariance matrix Ω_{NT} takes into account heteroskedasticity, first-order serial correlation and contemporaneous correlation resulting in the following contemporaneous covariances: $\hat{\sum}_{i,j} = \frac{\Sigma_{i,j}^{T} e_{i,t} e_{j,t}}{T}$. This then comprises the diagonal matrices in Ω from equation 5.2, which takes the form:

$$\begin{aligned} \hat{\Omega} &= \hat{\Sigma} \otimes I_T \\ PCSE &= (\mathbf{X}^T\mathbf{X})^{-1} \left\{ \mathbf{X}^T \hat{\Omega} \mathbf{X} \right\} (\mathbf{X}^T\mathbf{X})^{-1} \end{aligned} \tag{5.3}$$

I utilize the Wooldridge (2002) test of no serial correlation in the errors and reject the null hypothesis, which suggests that an autoregressive parameter should be specified in this particular model. Referring back to figure 5.1, it seems plausible that a unit-specific autocorrelation structure might be necessary in this case since the series all display somewhat unique trend lines just at first glance. In either scenario, using a common AR(1) parameter when a panel-specific parameter is necessary or using panel-specific AR(1) parameters when a common parameter is appropriate, the standard errors might be underestimated especially in small samples leading to overconfidence in the coefficient estimates. That being said, if the two methods yield residuals that are effectively the same, the resulting inferences will largely be the same as well. For this reason, I first fit three models:

1. OLS with PCSE's and panel specific AR(1) parameters,

2. OLS with PCSE's with a single common AR(1) parameter,

3. OLS without including a correction for autocorrelation.

For each model, I generated the residuals and then assessed four things:

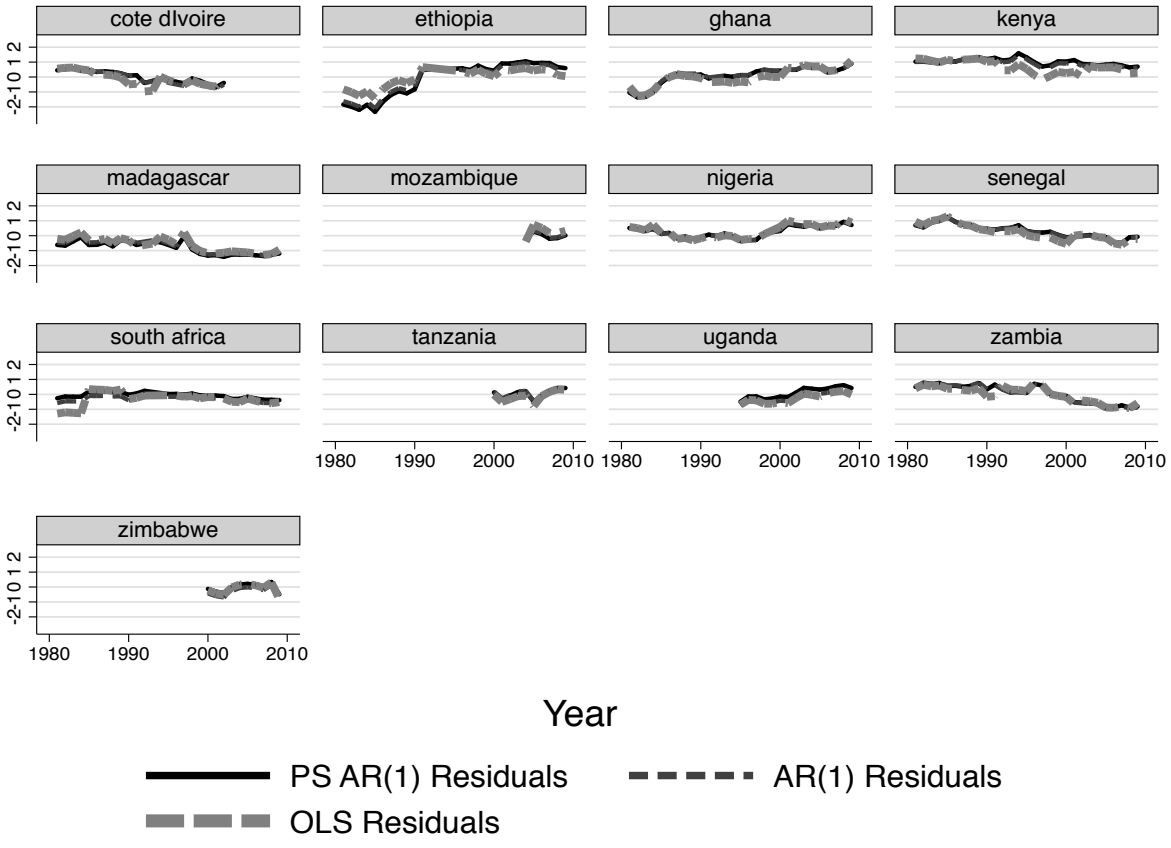
1. whether the AR(1) parameters estimated in the panel-specific AR(1) model were consistent across countries,

2. whether the common AR(1) parameter was substantially different from the parameters estimated in the PSAR(1) model,

3. the correlation between the residuals from each model, and

4. a plot of the residuals from each model against time to visually examine the extent of their difference (if any).

Figure 5.3 Residuals for OLS, AR(1), and PSAR(1) models



In each case, the common AR(1) and the PSAR(1) parameters are effectively identical: the AR(1) parameter (0.81) is in the middle of the country-specific AR(1) parameters[4], which indicates that the degree of autocorrelation the model is dealing with is similar across different countries (although not perfectly so). Across all three models, the residuals themselves are highly correlated: the lowest of the three correlations is 0.88 and the correlation between the AR(1) and PSAR(1) residuals is 0.98. Finally, looking at line plots in figure 5.3 of each of the three types of residuals shows that they are very similar as well. These findings combined with the fact that the substantive interpretation of the model does not change between the two autocorrelation specificiations, I choose to estimate the OLS model with PCSE's using a panel-specific AR(1) parameter.

One requirement for the estimation of time series models is that the data must be stationary; in other words, the series themselves should have a consistent data generating process such that the means, variances and autocovariances (at lag s) remain the same over time:

$$Cov(\hat{\beta}) = (\mathbf{X}^T\mathbf{X})^{-1}\left\{\mathbf{X}^T\Omega\mathbf{X}\right\}(\mathbf{X}^T\mathbf{X})^{-1} \tag{5.4}$$

If the series are not stationary, then the estimation might produce spurious results (Grander and Newbold 1974). Consider a model with the following first order process:

$$y_t = \rho_1 y_{t-1} + \varepsilon_t \tag{5.5}$$

The value of the ρ parameter reflects how much the past determines the future; it reflects the the presence or absence of stationarity in the series. If $|\rho| \geq 1$ then the series is not stationary. In many cases, ρ follows a unit root process where $|\rho| = 1$ and first-differencing the series in question will likely make it stationary, but this becomes more complicated in the presence of many cross-units over time. The unit roots tests for models that vary over unit and time can only detect whether or not stationarity exists in *all* of the panels but cannot detect which panels have unit roots.

Panel data models with differenced dependent variables are exactly equivalent to fixed effects when $T = 2$ ONLY; for $T > 2$, they are not identical, but are usually similar. Both remove unit-level (time-constant, or between-unit) differences, which amounts to estimating a model that is

[4]which are, in order: 0.15, 0.27, 0.46, 0.73, 0.75, 0.79, 0.86, 0.86, 0.90, 0.90, 0.93, 0.94

"individual-specific" or "subject-specific" (SS) when using a lagged-dependent variable or something equivalent to it like the Arellano-Bond estimator. In contrast, both PCSE and GEE are "population-averaged" (PA) models. The difference is not semantic in that PA models are different models from SS models because it substantially alters the question the researcher is asking based on the estimation technique. Essentially, if the researcher is interested in modeling the changes between observations across time, then SS models may be appropriate, but if the researcher believes that the variation happens in levels, then first-differencing the data for the sake of stationarity will essentially wipe out all of the cross-unit variation. For my theory specifically, the interesting variation happens in levels and not within units. Furthermore, some of the variables themselves are time invariant within countries and would be dropped from the model; these variables were not included as controls but instead to explain interesting variation in the data across units.

Furthermore, PA models are more appropriate here specifically because I am more interested in the marginal effects than the conditional effects. Theoretically, it makes more sense to think in terms of the average change across units when looking at national policy choices. Part of the motivation of this research is to "bridge the gap" so to speak between different disciplines and explanations of policy choice, which means that the estimation strategy should be amenable to predictions outside of the sample. In a first differenced model, the ability to make inferences outside of the sample are washed away and while it may be useful in some instances to understand and interpret changes between observations for one country, I am more interested in average effects in levels. Even though the countries found in this particular analysis are found in the same region of Africa, the inferences I can draw from my analysis are more generalizable in nature given that many of the covariates measure attributes that can be found across a large number of countries outside the sample. In other words, my research questions are not particular to the 13 countries contained in my dataset and therefore, the average effects are what I should model given my theory. Because of this, I have chosen to model the relationships that get the coefficients "right" while understanding that the autocorrelation in the errors is to bias the standard errors downward. Therefore, in order to adjust for serial correlation in the errors, I will fit Prais-Winston standard errors and include a

GEE model as a robustness check[5].

The results of the analyses are found in table 5.3. Model 1 is the collective action model which utilizes the three collective action indicators that I discussed above along with various control variables of interest. Model 2 contains the institutional variables of interest along with the various control variables. Lastly, model 3 specifies the full model with collective action indicators, institutional variables and control variables.

5.6.2 Collective Action Model

I refer here to model 1 in table 5.3 which contains the results of the model which only takes the collective action and control variables into account and takes the following form:

$$\begin{aligned} AGRD_{i,t} = &\beta_0 + RuralPopDens_{i,t}\beta_1 + CivSocPart_{i,t}\beta_2 + PermCrop_{i,t}\beta_3 + \\ &LogGDPpc_{i,t}\beta_4 + RR_{i,t}\beta_5 + LL_{i,t}\beta_6 + (RR_{i,t} \times LL_{i,t})\beta_7 + \varepsilon_{i,t} \end{aligned} \tag{5.6}$$

$$i = 1, ..., N;$$

$$t = 1, ..., T$$

This particular model produces an R^2 statistic of 0.79, which indicates that the model explains much of the variance in the dependent variable. More specifically, rural population density, civil society participation, and permanent cropland, have positive slope coefficients which coincides with my hypotheses on the aforementioned collective action variables. Furthermore, the coefficients on the controls for resource rich countries and economic development are positive and significant at the 0.001 and 0.01 level respectively. That being said, the interaction between resource rich and the landlocked variable is in the expected direction, but did not reach statistical significance at the 0.05 level.

[5]Found in tables B.4 - B.5 in Appendix B

5.6.3 Institutional Model

Model 2 in table 5.3 takes the main institutional variables into account, namely those associated with executive tenure, executive regime type, political competition and the population in power. This model takes the following form:

$$\begin{aligned} AGRD_{i,t} =& \beta_0 + LogGDPpc_{i,t}\beta_1 + RR_{i,t}\beta_2 + LL_{i,t}\beta_3 + (RR_{i,t} \times LL_{i,t})\beta_4 + \\ & PolComp_{i,t}\beta_5 + YrsOffice_{i,t}\beta_6 + Presidential_{i,t}\beta_7 + ExcludePop_{i,t}\beta_8 + \varepsilon_{i,t} \end{aligned} \tag{5.7}$$

$$i = 1, ..., N;$$

$$t = 1, ..., T$$

This particular model explains about 91% of the variance in the dependent variable as indicated by the associated R^2 value. Furthermore, political competition (-), years in office (+), and excluded population (-) are all in the expected sign and are statistically significant with confidence levels of at least 95%. The dummy for presidential system is neither in the expected direction (+) nor it is it statistically significant at the 0.05 level. Lastly, GDP per capita (+), resource rich (+), and the interaction between resource rich and landlocked (+) all display relationships in the expected directions based on my hypotheses and are all statistically significant coefficient estimates at the 0.001 level. The coefficient on landlocked is neither in the expected direction (-) nor is it statistically significant at the 0.05 level. Furthermore, it's sign has changed from model 1 where the coefficient estimate was negative and significant.

5.6.4 Full Model

The full model takes into account the collective action variables, the political institution variables and the control variables and takes the following form:

$$\begin{aligned} AGRD_{i,t} =& \beta_0 + RuralPopDens_{i,t}\beta_1 + CivSocPart_{i,t}\beta_2 + PermCrop_{i,t}\beta_3 + \\ & LogGDPpc_{i,t}\beta_4 + RR_{i,t}\beta_5 + LL_{i,t}\beta_6 + (RR_{i,t} \times LL_{i,t})\beta_7 + \\ & PolComp_{i,t}\beta_8 + YrsOffice_{i,t}\beta_9 + Presidential_{i,t}\beta_{10} + ExcludePop_{i,t}\beta_{11} + \varepsilon_{i,t} \end{aligned} \tag{5.8}$$

$$i = 1, ..., N;$$

$$t = 1, ..., T$$

The model itself produces an R^2 value of 0.86, which much like the previous two models, seems to indicate that a large amount of variance is explained by this model. All three collective action variable coefficients are positive and statistically significant, which gives support to my hypotheses. As for the political institutional variables, only one relationship is statistically significant and that is the negative relationship between political competition and agricultural R&D spending. All other political institution variables show the hypothesized relationship in terms of their impact on the dependent variable, but none of the remaining three reach statistical significant at the 0.05 level. That being said, all three would be considered statistically significant at the 0.10 level with years in office displaying a positive relationship with agricultural R&D and the presidential dummy and excluded population variables displaying a negative relationship with agricultural R&D spending.

5.6.5 Overall Model Fit

In order to compare the effects of the variables to one another in the model, the variables should be rescaled so that the measurement differences across variables are not driving the coefficient estimates up to very large and small values as is seen in table 5.3. I use the following equation to normalize the values between the interval (0,10):

$$X = (b-a)\frac{X - X_{min}}{X_{max} - X_{min}} + a \tag{5.9}$$

Using the normalized values should not change the interpretation of the models or the z-values from the original model, but will change the magnitude of the coefficients and standard errors. Referring to table B.1 in Appendix B, the interpretation of the two models is exactly the same as those interpretations from table 5.3. Table B.1 compares the coefficient estimates from the full models using the original values and the normalized values rescaled between 0 and 10. The coefficient estimates using the normalized values across the collective action model, institutions

Table 5.3 Determinants of Agricultural R&D Spending

	Model 1	Model 2	Model 3
Rural Population Density	0.00251**		0.00309***
	(2.86)		(4.21)
Civil Society Participation	0.772**		0.819**
	(2.58)		(2.94)
Permanent Cropland (%)	0.0471**		0.0380**
	(2.82)		(3.19)
ln(GDP Per Capita)	0.694**	0.698***	0.559***
	(3.28)	(7.05)	(4.72)
Resource Rich	2.025***	1.260***	1.787***
	(5.11)	(5.53)	(6.16)
Landlocked	-0.482**	0.978	-0.611***
	(-2.58)	(1.25)	(-4.98)
Resource Rich x Landlocked	-1.926	-2.871***	-1.441***
	(-1.93)	(-3.46)	(-3.80)
Political Competition		-0.0371**	-0.0422**
		(-3.20)	(-3.27)
Years in Office		0.00676*	0.00559
		(2.28)	(1.67)
Presidential System		0.136	-0.299
		(1.35)	(-1.69)
Excluded Population		-0.440*	-0.340
		(-2.04)	(-1.65)
Constant	-2.686	-1.246	-1.521
	(-1.91)	(-1.92)	(-1.77)
Observations	285	285	285
R^2	0.79	0.91	0.86

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

model, and full model are all found in the coefficient plot labeled figure 5.4 for comparison. Figure 5.5 displays the results from the full model only.

Table 5.4 Comparison of Original vs. Normalized Coefficients

	Full Model original values	Full Model normalized values
Rural Population Density	0.00309***	0.150***
	(4.21)	(4.21)
Civil Society Participation	0.819**	0.0712**
	(2.94)	(2.94)
Permanent Cropland (%)	0.0380**	0.0467**
	(3.19)	(3.19)
ln(GDP Per Capita)	0.559***	0.215***
	(4.72)	(4.72)
Resource Rich	1.787***	0.179***
	(6.16)	(6.16)
Landlocked	-0.611***	-0.0611***
	(-4.98)	(-4.98)
Resource Rich x Landlocked	-1.441***	-0.144***
	(-3.80)	(-3.80)
Political Competition	-0.0422**	-0.0338**
	(-3.27)	(-3.27)
Years in Office	0.00559	0.0179
	(1.67)	(1.67)
Presidential System	-0.299	-0.0299
	(-1.69)	(-1.69)
Excluded Population	-0.340	-0.0303
	(-1.65)	(-1.65)
Constant	-1.521	1.582***
	(-1.77)	(4.92)
Observations	285	285
R^2	0.86	0.86

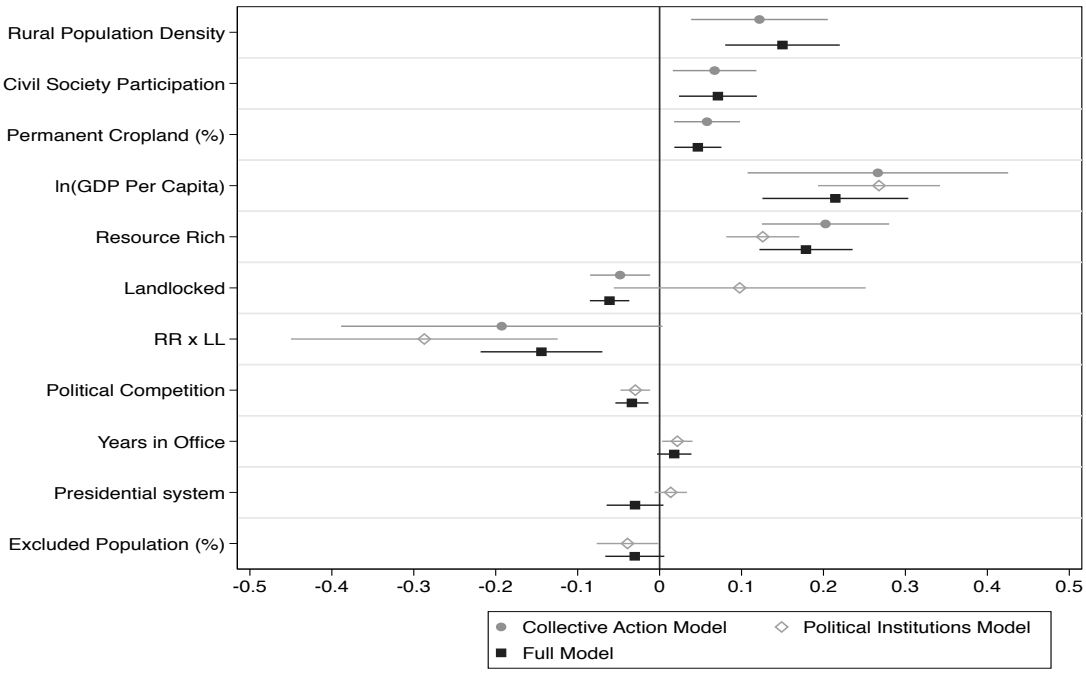
t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The first thing to note is that the coefficients across all models are fairly similar to one another in terms of their values. The landlocked variable stands out here in this respect because for the political institutions model, the landlocked coefficient value is positive and is not statistically

significant. Conversely, for both the collective action model and the full model the landlocked coefficient is negative and statistically significant.

Figure 5.4 Coefficient Plot with normalized values comparison



Moving to figure 5.5, one thing is clear from the full model: all of the collective action indicators are positive and significant whereas, the only significant institutional variable is political competition and that displays a negative relationship with agricultural R&D spending. Of the collective action indicators, rural population density has the largest impact which makes sense given the public goods nature of agricultural R&D spending. When the rural sector is less spread out, individuals and groups have more opportunity to observe what is going on around them. Agricultural production is unique in the sense that a lot of the work that goes into the production is very highly visible to neighbors. Not only does agricultural R&D have spillover effects into bordering countries, but these spillover effects can happen within the country as well. Monitoring and enforcement is much easier when the groups' actions are more visible and when interactions are repeated over time. If neighbors observe that agricultural R&D efforts seem to increase or improve production, they might be more likely to demand similar sorts of projects and investments for their

own crops in the hopes that results will be similar. Whats more, when farmers are concentrated rather than dispersed it makes it easier to deliver more public goods to larger areas where many people will benefit rather than narrowly targeting very dispersed groups in order to reach the same goal.

When it comes to the control variables both GDP-per-capita and resource rich produce positive and significant coefficients at the 0.001 level. The coefficient on landlocked is negative and statistically significant at the 0.001 level. For countries that are both resource rich and landlocked, the expectation is that overall, this interaction will negatively impact agricultural R&D spending.

Figure 5.5 Coefficient Plot with normalized values (full model only)

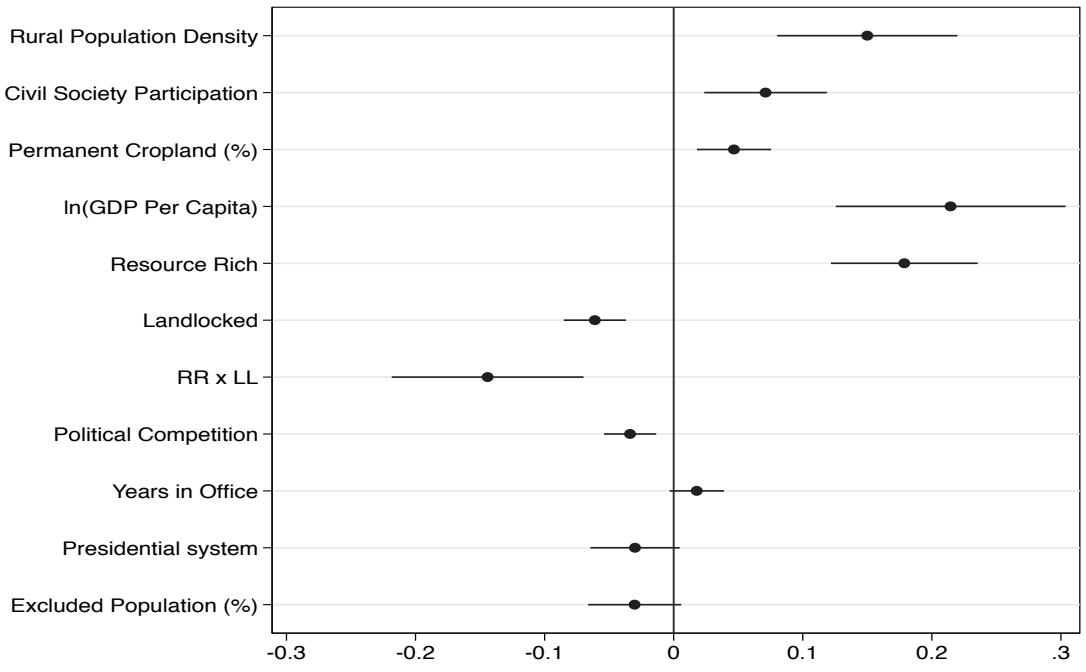
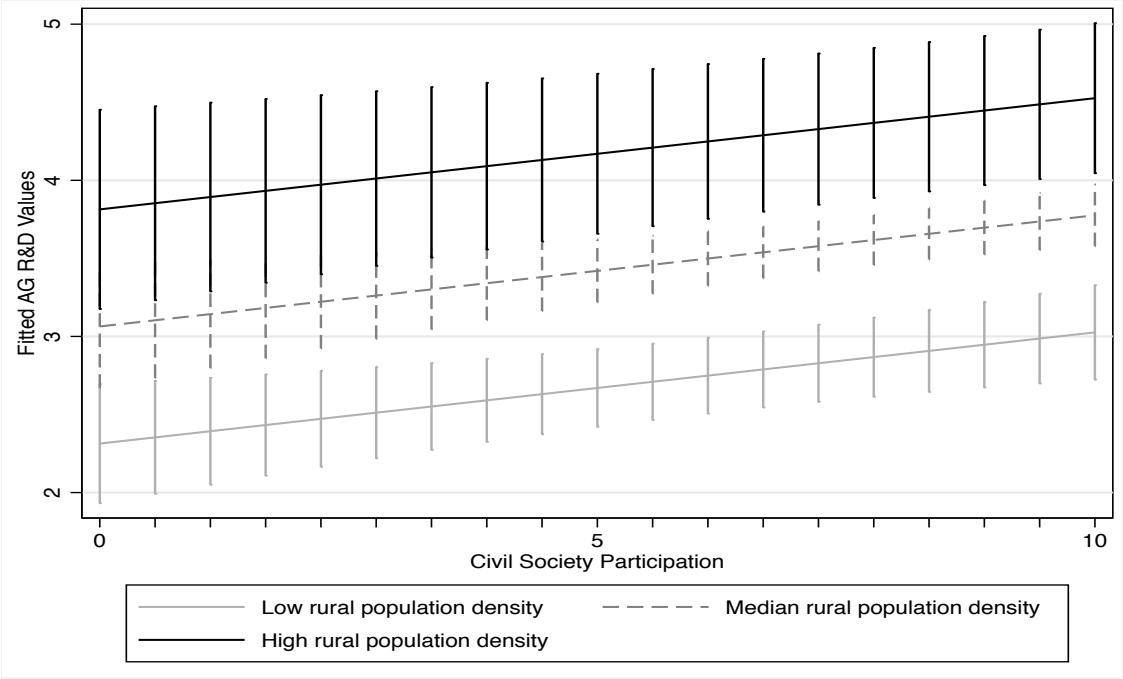


Figure 5.6 plots the predicted values of agricultural R&D spending across the civil society participation variable for low, median and high rural population density cases. The differences between the three categories becomes more apparent as one moves along the x-axis for the civil society participation variable. In particular, moving past 5 on the x-axis, one would observe that the median and low rural population density categories become more distinct as their confidence intervals get tighter and further apart from one another. Increases along the civil society participation

variable are associated with increases in agricultural R&D spending across the three categories, but the high rural population density category has the highest predicted spending whereas the low rural population density category has the lowest predicted spending amount.

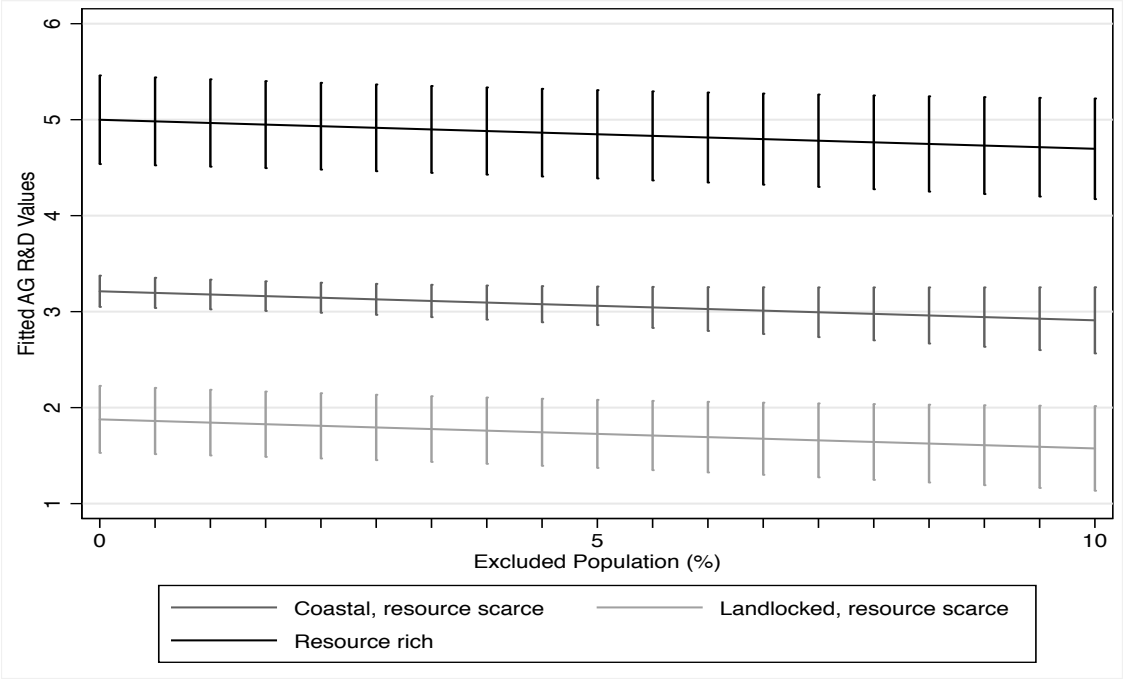
Figure 5.6 Predicted Values of AG R&D across Civil Society Participation & Different Levels of Rural Population Density



The predicted values of log agricultural R&D spending for landlocked, coastal and resource rich countries holding all other variables at their means are 1.83, 3.15 and 4.9 respectively. Looking at figure 5.7 shows how those values change as the excluded population increases across the x-axis. There is a clear negative impact across all three categories as the excluded population moves from no exclusion to full exclusion (indicated by 10 here after rescaling). Landlocked countries with very high levels of exclusion will find themselves in the worst spot when it comes to agricultural R&D spending, whereas resource rich countries with full inclusion should find themselves in the highest category when it comes to spending on agricultural R&D.

Looking at permanent cropland at the high and low ends across values of political competition in figure 5.8 shows how the competitiveness of a country can shape their spending priorities. Even though increases in permanent cropland should induce increases in agricultural R&D spending on

Figure 5.7 Predicted Values of AGR&D for resource rich vs. landlocked across excluded population



average, when there is more political competitiveness in the system, spending levels will be less than they would be otherwise. Because political competition requires political actors to stand out among their competitors, spending on public goods becomes less desirable the more prevalent the attribution issue is as it pertains to that public good.

And finally, figure 5.9 plots the predicted values of agricultural R&D across development level as measured by the log of GDP per capita. High levels of GDP per capita are associated with higher agricultural R&D spending although the confidence intervals are wider among the high values as well. Middle values of GDP per capita are associated with much tighter confidence bands. The associated predicted values range from 2.51 on the lowest end of GDP per capita up to 4.66 at the highest end.

Figure 5.8 Predicted Values of AGR&D for low vs. high permanent cropland across values of political competition

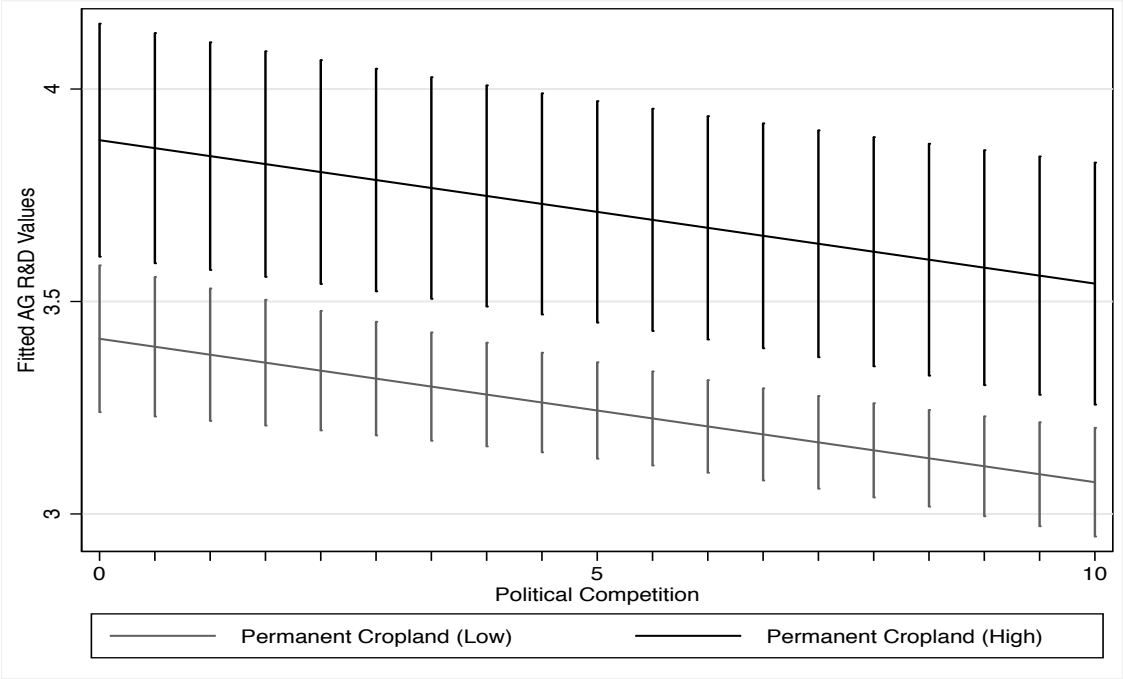
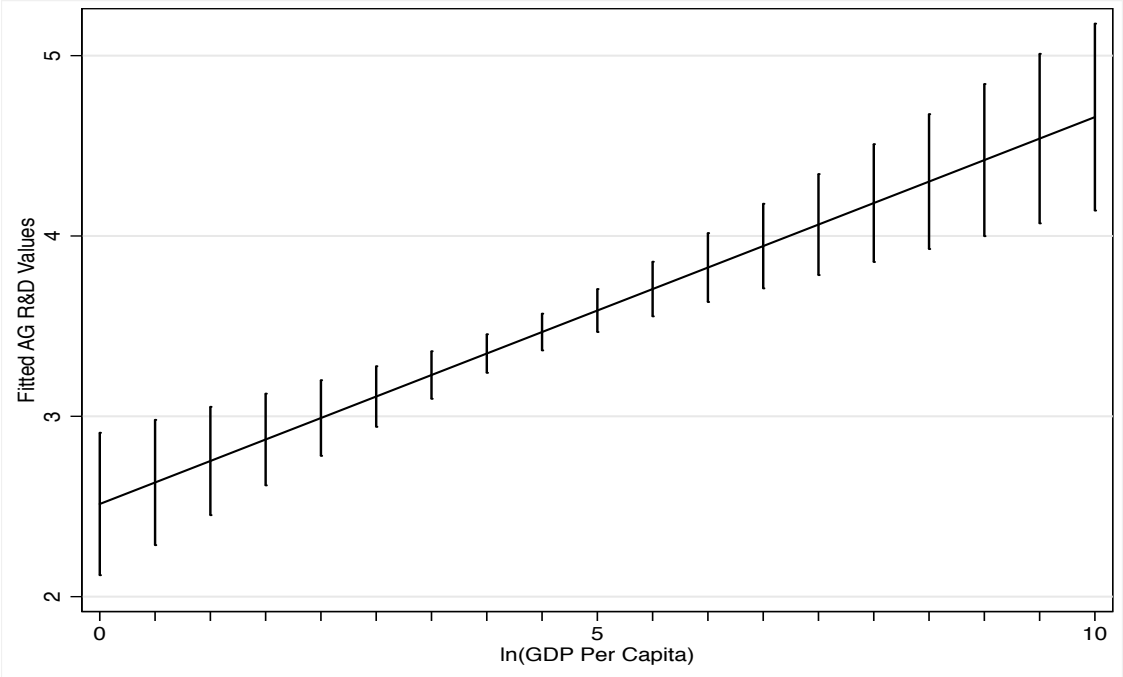


Figure 5.9 Predicted Values of AGR&D across logged GDP per capita values



5.7 Conclusion

The results of my analysis largely confirm my hypotheses about a country's collective action capabilities. When the political and structural environment of the country is more conducive for mobilization, then the more likely it will be that the state will spend more on a public good like agricultural R&D. The only institutional variable that might dampen this relationship is political competition and that is due to the nature of agricultural R&D spending. Because public goods in general have a low attribution rate and agricultural R&D spending specifically has a long lag time for results, highly competitive systems incentivize political actors to choose policies that make electoral success more likely, which are not usually associated with spending on goods with the aforementioned characteristics.

CHAPTER 6

CONCLUSION

6.1 Primary Contributions

The first major contribution to the body of work on agricultural policy is in my effort to unify the theories across the various disciplines and sub-disciplines that attempt to explain agricultural policy choices in developing countries and more specifically, in sub-Saharan Africa. By linking previous studies' theories and findings together, I formulated my own theories and hypotheses about the motivations and actions of both principals (voters) and agents (governmental actors), which drives the policymaking process. As a result of this effort, I hope that researchers and policy practitioners alike will acknowledge the benefits of a multi-disciplinary approach to understanding public policy, in general, and agricultural policy, more specifically.

In addition to this, my second major contribution is the model I develop in order to provide quantitative evidence to support my unified theory. This leads me to a further point about the analysis itself, which makes use of alternative measures of concepts that are commonly of interest to those who study (agricultural) policy within political science, political economy, development economics and agricultural economics. The analysis relies on time series cross-sectional (cross-country) data that I merged, through a theory-driven approach, from various disciplinary sources. The model itself is a parsimonious representation of the factors that simultaneously impact agricultural policy. The results of the model provide evidence to support my contention that a country's collective action capabilities, political institutions, and overall resources impact the types of agricultural policies that are delivered nationwide.

And lastly, there are very few studies in this area that focus specifically on the determinants of agricultural research and development spending. Because of this, I am filling a large gap in the literature which is, in particular, lacking in quantitative studies in this area. More specifically, my findings suggest that of the factors that influence this policy area, the most pivotal are those that

fall under "collective action capabilities" compared to the factors related to political institutions. This should be of particular importance to those who are interested in the relationship between democratization and development. The majority of studies about agricultural production and growth are in resounding agreement that investments in agricultural research and development confer the highest rates of return compared to other policy options like fertilizer subsidies or even extension services. This is particularly true in sub-Saharan Africa where dollar for dollar, the rate of return from investments in agricultural research and development far outnumbers any other investments. But as I have pointed out, investments remain low and moreover, the findings in my analysis support the argument that mobilization capacity is crucial to securing more investment in these types of activities.

6.2 Summary of Findings

With the use of time series cross-sectional data, I identify through my analyses the various factors that impact two different areas of agricultural policy: agricultural price distortions and agricultural research and development spending. Chapter 4 focused on the determinants of agricultural price distortions, or in other words, governmental policies that change the returns to farmers for their goods. My findings demonstrate that the choice will be born out of a combination of the collective action capabilities of the nation and the political institutions present there. Overall, I find support for my hypothesis that countries with environments that are more conducive to the organization over shared economic interests, will choose pricing policies that assist the agricultural sector. My model results support this general hypothesis with through the positive and statistically significant coefficient estimates for all three collective action indicators. As for the political institutions, the results support the idea that competitive electoral systems incentivize political actors to choose policies that will make them more likely to win; in this scenario, the outcome should be pricing policies that support agriculture more because the majority of people rely on agriculture for their livelihood. Also, as previous studies suggested, proportional representation and mixed

electoral systems protect their agricultural sector more through pricing policies compared to plurality/majoritarian systems.

Chapter 5 revolved around the political determinants of agricultural research and development spending across countries and time. The results from my analysis support my hypotheses about the impact that the collective action environment has on agricultural R&D spending. More specifically, I hypothesized that higher rural population density and larger proportions of permanent cropland leads to more spending on agricultural R&D spending. I also hypothesized that a more open and participatory civil society environment should lead to more spending on agricultural R&D. All three of my hypotheses related to collective action are supported by the results of my model. Furthermore, I hypothesized that institutional environments that incentivize political actors to cater to and be more accountable to larger groups of individuals rather than smaller, specialized interests will spend more on public goods like agricultural R&D. This hypothesis was supported in my model because more competitive electoral systems are predicted to invest more in agricultural research and development.

6.3 Implications for Agricultural Policy in Ghana

Post-independence and through the mid-1980's, agricultural policies in Ghana were quite detrimental to the economy in general, but especially for the agricultural sector. As was the case with many countries in sub-Saharan Africa, Ghana used marketing boards to set prices and often redirected funds away from agriculture into other sectors of the economy. Today cocoa production makes up 8.2% of the country's GDP and is the largest cash crop in the country, but even during the post-independence era, cocoa made up the largest source of government revenues (Anderson and Masters 2009). Starting in 1961, the Cocoa Marketing Board (CMB) established a monopoly on purchasing cocoa; all cocoa had to be bought and sold through the CMB, which established fixed nominal prices for cocoa. The president at the time, Kwame Nkrumah, extracted very heavily from the CMB's surpluses to finance other governmental projects instead of using politically

unpopular tariffs. Peasant farmers were the largest producers of cocoa and according to Leith and Soderling (2000), they were not part of Nkrumah's loyal constituency; prior to 1984, agricultural policies were skewed toward the interests of large farmers who had access to the state machine (Anderson and Masters 2009). World cocoa prices fell significantly during the mid-1960's, which meant that the government could not rely on their extractions from the cocoa sector's surpluses. And because cocoa is a perennial crop [1], the supply of cocoa kept climbing even as world prices dropped. This started the economic collapse that continued through the mid-1980's.

The country then experienced many political upheavals through a series of military coups beginning with the ousting of Nkrumah between 1966-1981, which allowed for political elites to exploit the CMB in order to establish patronage networks and expand the size and role of the state. Following a coup led by Jerry Rawlings, the Provisional National Defense Council (PNDC) was set up with a populist agenda to deal with rampant governmental corruption in Ghana. Simultaneously, drought and forest fires were wreaking havoc on cocoa farms, which dealt further blows to an already fragile Ghanaian economy. Between 1965 and 1981, Ghana fell from producing 36% of the world share of cocoa to just 17% (Anderson and Masters 2009). According to Brooks et al. (2009), around 2.5% of the population was employed by the state in some form by 1984. And as Ayinde (2014) reports, because the government relied very heavily on revenue from cocoa to support patronage networks, "the cocoa industry was on the brink of collapse, along with the Ghanaian economy as a whole" (54).

Post-1984, Ghana instituted a set of economic and market reform measures meant to deal with the devastation caused by the preceding period's economic and political instability. The International Monetary Fund (IMF) and World Bank supported these measures and emphasized removal of many of the direct price controls and governmental interventions in the market. Agricultural policies were largely aimed at privatization of state-owned farms, the removal of price controls and a reduction in direct input supports like fertilizer subsidies. The Ghana Cocoa Board (Cocobod) replaced the Cocoa Marketing board in 1979 and began to implement some of the market

[1] A perennial crop is one that takes more than two years to mature for harvest

reforms with respect to the cocoa sector, one of which was the removal of input subsidies to cocoa. Between the period of 1984-1991, the economy improved and real GDP at about a rate of 4% per year (Brooks et al. 2009). At the same time, the reforms were instituted by an authoritarian regime and the PNDC government was not especially responsive to outside pressures from various interests (Leith and Soderling 2000).

It was not until elections in 1992 that the government became more responsive to outside pressures. One of the most important issues during election were the discussions and conflicts that arose over reforming the cocoa sector (Leith And Soderling 2000). With the removal of input subsidies to the cocoa sector by Cocobod in 1989, the price of inputs went up heavily and with pressure from farmer organizations, "the government reduced the price of insecticides and fungicides in 1994" (Brooks et al. 428). Cocobod also instituted major reorms like allowed licensed companies to compete with state-owned companies that buy the products. They also allowed licensed buying companies to start exporting what they buy with a cap at 30% of their purchases. Due to these changes, the cocoa sector has rebounded in many ways from the pre-1984 levels and now makes up 21% of exports.

So what to make of all these changes to Ghana's cocoa industry? Since the early 1990's, the cocoa sector has grown both in size and extent to which it contributes to Ghana's economy overall. In 1992, the percent of agricultural households involved in cocoa production was 19.7% which increased to 27.8% by 2006 (Mawunyo and Udry 2017). Cocoa itself is a product with highly specific assets. It is a perennial tree crop, so it takes many years for the crop to mature for harvest. The increase in cocoa farmers and the highly specific nature of the assets involved make it so that cocoa farmers may be more likely to demand policies for their benefit. Since 2005, Ghana has experienced a level of political competition that is characterized by people who take on multiple identities (party, ethnicity, region, etc) and therefore, express their preferences through those groups in different ways since the groups' preferences do not overlap much. Opposition to the ruling group(s) usually takes the form of competing ethnic groups who try to advance their own co-ethnics, although Ghana is considered a transitional case in the process of making changes

to this pattern of inter-ethnic competition. It is helpful to think about where cocoa is produced compared to where ethnic groups tend to reside in the country. Cocoa is mainly produced in the southern half of the country in the Brong-Ahafo, Ashanti, Western, Eastern and Volta regions. The Akans ethnic groups are largely concentrated in the Brong-Ahafo, Western, and Eastern Regions of the country. The Asante are heavily concentrated in the Ashanti region. The Ewe are concentrated more heavily in the Volta Region. Because political competition is still heavily tied to ethnicity, and no single ethnic group seems to dominate the production of cocoa, then it might be very difficult for cocoa producers in general to impact pricing policies that specifically benefit cocoa producers. And not only that, but the excluded population is zero in Ghana. As my theory suggests in chapter 4, as more ethnic groups are included in the political process, it becomes more difficult for any single group to target benefits to their own ethnic group. Although, when it comes to public goods, the more inclusive the political system, the higher the provision of public goods like agricultural R&D. Between the years 1980 and 2008. the spending on agricultural R&D has increased substantially from 17% of agricultural GDP to 62% of agricultural GDP. Indeed, looking at the specific expenditure rates to particular crops, the Cocoa Research Institute of Ghana (CRIG) made up 51.4% of the share in governmental crop research in 2008(IFPRI 2013). Given the growing size of the cocoa sector and the cost and specificity of assets, this huge spike in agricultural R&D spending for cocoa is to be expected from my estimations in chapter 5.

6.4 Limitations of the Study

My analysis does suffer from some limitations, one of which is distinctly related to the study of sub-Saharan Africa: the availability of data and the accuracy/credibility of the data utilized in this study. Researchers who study sub-Saharan Africa, across all disciplines and sub-disciplines, often struggle with the unavailability of data across the region and this is particularly prevalent in studies that rely on agricultural data. In many of these instances, it is not always clear if the data is missing at random or if there is some systematic reason why certain data points are not available for

a particular measure. Low bureaucratic quality and a lack of investment in accurate data gathering organizations and institutions tend to be one of the major reasons why data is unavailable. But even if that is the case, one could make the argument that this means the data is missing at random or that it is systematic because low bureaucratic quality may often be the norm in many countries in SSA.

Furthermore, because agricultural data is often linked to development-type goals, it may be the case that the official statistics are misreported (Sandefur and Glassman 2014). Sometimes the data are inaccurate because outside donors want to see results and if those results are not produced, future funding could be cut off. One of the main findings in Morten Jerven's work (2013) is that crop statistics are often politically motivated. For example, Nigeria has frequently had drastically different measures of food crop production depending on the organization that reports the statistics. For the Federal Office of Statistics, the estimates tended to be much smaller than estimates by the Food and Agriculture Organization or the U.S. Department of Agriculture. This is prevalent across the continent and as Jerven points out:

> "Statistical reform has been slow and incomplete — and some unintended consequences of some structural adjustment reforms include the deterioration of statistical capacity. It is clear that liberalization and decreasing the role of the state limits both the incentive and the ability of states to collect information. But the need for data has not decreased . . . the ability of and the incentive for states to monitor their own development has decreased" (Jerven 2013, p.52).

For this reason, it is often the case that researchers and practitioners may not know for certain whether their measures are accurate or credible or why some data points are missing.

6.5 Future Research

Despite the aforementioned shortcomings, I do believe there is ample room for more detailed quantitative research in this area. One aspect I would like to tackle in particular is the link between

ethnic geography and crop location. To elaborate, ethnic groups often inhabit particular geographic locations and remain close to one another. Further, the production of certain crops tends to be concentrated in particular areas either because they have to be produced in that particular type of agro-environment and/or a particular group has traditionally produced a particular agricultural good. One study attempted to utilize this information to link executive ethnicity to the tax or subsidization of crops from the executive's home region (Kasara 2007). This study found that when the executive comes from a cash crop region[2], farmers in those regions are more likely to face higher tax rates than if the executive did not come from that particular region. The study itself is an illuminating first attempt to establish that ethnic group membership and ethnic geography are linked to particular agricultural policy decisions through a quantitative analysis.

Because the Anderson and Venezuela Data disaggregates the nominal rates of assistance by product, I would like to to parse out the relationship that exists, if any, between ethnic group membership and the level of taxation that particular groups face for their products. That is to say, I want to analyze whether executive ethnicity is linked to higher rates of protection or taxation for products that are associated with the region and ethnic group of the executive and ethnic group if power. In order to do that, I would like to exploit the relevant geocoded data, which is available for such purposes. The data itself contains information on the following:

- ethno-politically relevant ethnic groups, which was used in my analysis here, albeit in a different way,
- geocoded data on ethnic group concentration and location, and
- geocoded data on crop production

I have geocoded data on both ethnic group location within sub-Saharan Africa and crop production location. The crop data comes from the Harvest Choice identification (HCID) database

[2]In this particular study, this refers to a region that produces one or more of the following crops: cocoa, coffee, cotton, groundnuts, tobacco.

with data on pairs of coordinates of crop data (HarvestChoice 2010). I also have geocoded ethnicity data from the Ethnic Power Relations (EPR) organization that contains polygons (regions) that locate ethnic groups (Wimmer, Cederman and Min 2009). This means that every point in the crop data exists in the "region" defined by one or more ethnic groups. I can use that data to formulate aggregate measures by country on which ethnic groups are growing which crops. The steps toward utilizing this data is as follows:

1. Associate each point's crop data with each ethnicity's region, so that for each point I know which ethnicities are associated with that location's crop data.

2. Create point-level aggregates of the combined data so at each point, there is data on the ethnic composition at that same location.

3. Then build country-level scores by aggregating the population-weighted ethnicity scores with the crop data.The population weighing is necessary to deal with ethnic minorities that are nonetheless very spread out geographically.

The end result would be a measure of the degree to which an ethnic group is associated with a particular crop or crops. Putting this data together would be advantageous in this area of research for a few reasons. First, it would allow for an analysis that investigates the link between ethnic group membership and governmental benefits, particularly in the agricultural sector. Many studies have shown a direct link between goods like fertilizer subsidies or price supports based on ethnic group membership and ethnic geography. There has yet to be an attempt to make this link quantitively using this kind of fine-grained data, which is something I would like to undertake. Second, it would also allow for a more direct investigation of spillover effects and their impact on the relevant actors' decisions to choose particular public goods like agricultural research and development.

I would also like to further expand this research into other developing regions of the world besides sub-Saharan Africa. Indeed, the relevant data is available for other regions, which would allow me to do this relatively easily. Looking at data on the relative rate of assistance, there are

currently measures for 82 countries. Among the developing world, measures are observed for 12 countries in Asia, 8 countries in Latin America, 13 countries in Europe and 4 in the Middle East and North Africa.

6.6 Conclusion

Within sub-Saharan Africa, agricultural policy change is typically characterized by stagnation; that is to say, change is very slow and/or minor, even in the face of food shortages, droughts, and food riots. Indeed, the region itself is marred by a complex set of political, economic, and geographic factors that negatively impact the most vulnerable groups among the population. These groups often find themselves in this vulnerable position for years or even decades, with no systematic way to alter the situation or to seek recourse. More often than not, the rural poor finds itself in this position even though, with the exception of South Africa, the rural sector makes up the majority of voters in the countries studied here. In fact, South Africa, with its small rural population, has actually enjoyed a combination of policies that are quite beneficial to the agricultural sector with a combination of price supports and larger budget allocations to agricultural research and development.

This study is important because a very large number of people are impacted by these policies in very substantial ways. Agricultural policy decisions affect the economic well-being of those who work in the agricultural sector, but even more importantly, these policies affect the production and availability of the most basic of needs: food. If we are to evaluate the major regime changes and institutional changes that have taken place in the region, we must also look to the policies that are produced by these systems. If policy decisions make it so that even the most basic necessities of life cannot be met, then I am not sure of a more clear indication that democratic institutions have not taken hold. Elections are not enough if basic expectations of democratic citizenry are not met on a regular and consistent basis. Previous studies have either relied too little on the political factors that impact agriculture or perhaps relied too much on only a select few, like the presence of

elections. Outside of election time, if the political environment does not protect and/or encourage citizens' rights to engage and hold governmental actors accountable on a regular basis, it seems unlikely that the status-quo, anti-agricultural bias will change based the analysis here.

APPENDICES

APPENDIX A

AGRICULTURAL PRICE DISTORTION MODELS

A.1 Measurement Details for Relative Rate of Assistance

Anderson and Venezuela come up with a measure of price distortions that takes into account both policies that directly and indirectly impact agricultural prices. In order to do that, they must first come up with measures of price distortions to the agricultural sector. One way that countries distort prices for products is through border price supports. This might come by way of a tariff on competing imported products and/or through export subsidies (or taxes). Both of these kinds of border price supports make up the first part of the nominal rate of assistance, the NRA_{BS}. The government might also engage in domestic price supports through subsidies to farmers, which is denoted as NRA_{DS}. Taking both of these together while also taking into account the exchange rate distortions gives an estimate of the NRA to output or NRA_o. Also taken into account are distortions to farm inputs like subsidies on fertilizers, which are denoted as NRA_i. Finally, the NRA is calculated as $NRA_o + NRA_i$. An estimate of the NRA is calculated for agricultural tradables and non-agricultural tradables by taking the weighted average of all the covered and noncovered products ($NRAag^t$). The covered products account for 70% of all farm production with about 30% in the uncovered category. Covered products include major food items like rice, wheat, maize, soybeans, sugar, and milk. Other products include key staples like tea, coffee and cotton. It also includes various fruits and vegetables.

In order to get an estimate of the *relative* rate of assistance, a similar procedure is followed in order to get a measure of the NRA to the non-agricultural sector ($NRAnonag^t$), which includes sectors like fishing and mining. Finally, the relative rate of assistance (RRA) is calculated as follows:

$$RRA = \left[\frac{1 + NRAag^t}{1 + NRAnonag^t} - 1 \right] \tag{A.1}$$

A.2 Models using Nominal Rate of Assistance as Dependent Variable

A.3 Models with normalized variables

The following table A.2 provides all of the coefficients from the models estimated using the normalized values from chapter 4, section 4.5. The interpretation of the results are the same as the 4.3 even if the magnitude of the coefficients is different.

A.4 Robustness Checks

I also estimate the same models as in table 4.3, but utilize a different measure of political competition. This particular dichotomous measure (EIEC) is specified in chapter 3 and is originally from the Database of Political Institutions (Beck et al. 2001). Table A.3 includes the estimates of the coefficients using the alternative political competition variable for both the institutions model and the full model. Table A.4 compares the estimates of the full models with the two different specifications of the political competition variable.

Table A.1 Determinants of Agricultural Pricing Policy (NRA)

	Model 1	Model 2	Model 3	Model 4
Rural Population Density	0.00112***	0.00100***	0.000932***	0.00113***
	(5.37)	(5.14)	(4.17)	(4.61)
Political Competition	0.00739	0.00275	0.00415	0.00483
	(1.00)	(0.46)	(0.66)	(0.81)
Civil Society Participation	0.162	0.255*	0.261**	0.146
	(1.28)	(2.39)	(2.61)	(1.32)
ln(GDP Per Capita)	-0.0301	-0.0424	-0.0486	-0.0497
	(-1.05)	(-1.38)	(-1.49)	(-1.58)
Resource Rich	0.298***	0.273***	0.261***	0.301***
	(6.35)	(6.14)	(4.47)	(5.01)
Landlocked	0.0297	-0.0426	-0.0387	-0.0317
	(0.45)	(-1.15)	(-1.04)	(-0.80)
Resource Rich x Landlocked	-0.555***	-0.502***	-0.452***	-0.468***
	(-7.28)	(-8.03)	(-6.14)	(-6.00)
Proportion Representation System	0.267***	0.254***	0.261***	0.322***
	(4.77)	(4.70)	(4.47)	(4.99)
Mixed System	0.140**	0.137**	0.154***	0.217***
	(3.17)	(3.10)	(3.68)	(4.68)
Ethno-Politically Relevant Groups	0.0278**	0.0315**	0.0258*	0.0354**
	(3.09)	(3.16)	(2.44)	(2.84)
Post-SAP Dummy	0.0777	0.0561	0.0560	0.0567
	(1.64)	(1.27)	(1.22)	(1.28)
Presidential System		-0.171	-0.162	-0.181
		(-1.82)	(-1.76)	(-1.92)
Minority Ethnic Group Power			0.0466	-0.0279
			(1.15)	(-0.50)
Permanent Cropland (%)				0.0149**
				(2.85)
Constant	-0.587*	-0.347	-0.315	-0.338
	(-2.43)	(-1.22)	(-1.05)	(-1.17)
Observations	339	339	331	331

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.2 Determinants of Agricultural Pricing Policy using normalized values

	Collective Action Model	Political Institutions Model	Full Model
Rural Population Density	5.039***		4.519***
	(7.65)		(5.13)
Civil Society Participation	4.705***		2.798***
	(8.46)		(4.22)
Permanent Cropland (%)	-0.225		1.867***
	(-0.96)		(4.13)
ln(GDP Per Capita)	1.439	-1.567	-0.760
	(1.62)	(-1.76)	(-0.92)
Resource Rich	3.405***	2.608***	3.669***
	(8.38)	(6.38)	(8.01)
Landlocked	-1.237***	-0.503	-1.060***
	(-3.97)	(-1.95)	(-4.41)
Resource Rich x Landlocked	-4.809***	-3.494***	-3.390***
	(-9.77)	(-7.33)	(-6.71)
Post-SAP Dummy	1.074**	0.423	1.111**
	(2.68)	(1.32)	(2.93)
PR electoral system		0.170	1.339**
		(0.37)	(3.06)
Mixed electoral system		0.372	2.303***
		(1.05)	(4.36)
Political Competition		3.548***	1.583***
		(9.93)	(4.15)
Presidential system		0.571	-0.658
		(0.86)	(-1.07)
Excluded Population (%)		4.609***	2.264***
		(7.38)	(3.50)
Constant	-82.26***	-49.89***	-73.44***
	(-11.61)	(-5.71)	(-8.63)
Observations	338	338	338
R^2	0.47	0.47	0.57

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.3 Determinants of Agricultural Pricing Policy (EIEC)

	Political Institutions Model	Full Model
ln(GDP Per Capita)	-8.244**	-2.219
	(-2.73)	(-0.74)
Resource Rich	24.44***	41.17***
	(5.74)	(7.52)
Landlocked	-13.46***	-10.65***
	(-4.22)	(-3.56)
Resource Rich x Landlocked	-26.70***	-36.35***
	(-5.00)	(-7.00)
Post-SAP Dummy	-0.262	8.857*
	(-0.08)	(2.43)
PR electoral system	14.17***	21.76***
	(3.76)	(4.77)
Mixed Electoral System	9.236*	32.10***
	(2.13)	(4.63)
Political Competition (alternative)	19.63***	3.294
	(6.54)	(1.14)
Presidential System	-8.836	-16.86
	(-0.86)	(-1.93)
Excluded Population	17.49*	1.592
	(2.08)	(0.19)
Rural Population Density		0.125***
		(5.45)
Civil Society Participation		31.71**
		(3.09)
Permanent Cropland (%)		0.988**
		(3.23)
Constant	17.06	-65.89**
	(0.69)	(-2.73)
Observations	349	349
R^2	0.33	0.44

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.4 Model Comparisons using Alternative Political Competition Variable

	POLCOMP Model	EIEC Model
Rural Population Density	0.105***	0.125***
	(4.59)	(5.45)
Civil Society Participation	21.81	31.71**
	(1.92)	(3.09)
Permanent Cropland (%)	1.516***	0.988**
	(4.09)	(3.23)
ln(GDP Per Capita)	-1.741	-2.219
	(-0.65)	(-0.74)
Resource Rich	38.84***	41.17***
	(7.20)	(7.52)
Landlocked	-7.225*	-10.65***
	(-2.05)	(-3.56)
Resource Rich x Landlocked	-34.53***	-36.35***
	(-6.55)	(-7.00)
Post-SAP Dummy	10.17**	8.857*
	(2.69)	(2.43)
PR electoral system	15.02**	21.76***
	(3.18)	(4.77)
Mixed Electoral System	26.83***	32.10***
	(4.12)	(4.63)
Political Competition	2.322***	
	(4.14)	
Presidential System	-12.32	-16.86
	(-1.43)	(-1.93)
Excluded Population	19.47*	1.592
	(2.19)	(0.19)
Political Competition (alternative)		3.294
		(1.14)
Constant	-72.36***	-65.89**
	(-3.36)	(-2.73)
Observations	339	349
R^2	0.46	0.44

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

APPENDIX B

AGRICULTURAL R&D MODELS

B.1 Models with normalized variables

Table B.1 Determinants of Agricultural RD Spending with normalized variables

	Collective Action Model	Political Institutions Model	Full Model
Rural Population Density	0.122**		0.150***
	(2.86)		(4.21)
Civil Society Participation	0.0671**		0.0712**
	(2.58)		(2.94)
Permanent Cropland (%)	0.0579**		0.0467**
	(2.82)		(3.19)
ln(GDP Per Capita)	0.266**	0.268***	0.215***
	(3.28)	(7.05)	(4.72)
Resource Rich	0.203***	0.126***	0.179***
	(5.11)	(5.53)	(6.16)
Landlocked	-0.0482**	0.0978	-0.0611***
	(-2.58)	(1.25)	(-4.98)
RR x LL	-0.193	-0.287***	-0.144***
	(-1.93)	(-3.46)	(-3.80)
Political Competition		-0.0297**	-0.0338**
		(-3.20)	(-3.27)
Years in office		0.0216*	0.0179
		(2.28)	(1.67)
Presidential system		0.0136	-0.0299
		(1.35)	(-1.69)
Excluded Population (%)		-0.0391*	-0.0303
		(-2.04)	(-1.65)
Constant	1.039**	2.115***	1.582***
	(2.68)	(10.32)	(4.92)
Observations	285	285	285
R^2	0.79	0.91	0.86

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.2 Determinants of Agricultural RD Spending with normalized variables

	Collective Action Model	Political Institutions Model	Full Model
Rural Population Density	0.122**		0.159***
	(3.07)		(5.17)
Civil Society Participation	0.0513*		0.0953***
	(2.02)		(3.75)
Permanent Cropland (%)	0.0550*		0.0423*
	(2.47)		(2.52)
ln(GDP Per Capita)	0.229***	0.194***	0.266***
	(4.47)	(3.88)	(6.27)
Resource Rich	0.181***	0.169***	0.168***
	(6.29)	(7.45)	(7.55)
Landlocked	-0.0225	-0.0162	-0.0338
	(-0.71)	(-0.54)	(-1.49)
RR x LL	-0.177***	-0.206***	-0.162***
	(-3.38)	(-4.90)	(-4.56)
Political Competition		-0.0154	-0.0346**
		(-1.44)	(-2.76)
Years in Office		0.0154	0.0188
		(1.38)	(1.55)
Presidential system		-0.0119	-0.0324
		(-0.61)	(-1.67)
Excluded Population (%)		-0.0109	-0.00807
		(-0.43)	(-0.36)
Constant	1.236***	2.541***	1.195***
	(3.61)	(7.87)	(3.54)
Observations	285	285	285
R^2	0.65	0.64	0.72
ρ	0.89	0.87	0.81

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

B.2 Assessing Model Fit

Originally I hypothesized that electoral system would have an impact on the level of agricultural R&D spending. Including the dummy variables for proportional representation and mixed electoral systems with the rest of the full model from chapter 5 would produce the estimates found in B.3 under model 2. The original full model from chapter 5 is found under model 1 in the same table. The coefficients for both of the dummy variables is insignificant in model 2 here and produces very low z-values. In order to formally test the joint significance of these two variables, I use a Wald test, which produces a Wald statistic of 0.77. This is lower than the critical chi-square value of 5.99 at the 95% confidence level, which is why I do not include these dummy variables in the models from chapter 5.

B.3 Assessing Linearity Assumption

In order to use linear regression to model relationships between variables, one must assume that the true relationship can be modeled through a linear function of a random variable such that $\mathbf{y} = \mathbf{X}\beta + \varepsilon$. One way to visually assess the linearity assumption is to plot the residuals of the model against the predicted values from the model. If the residuals do not show any clear nonlinear patterns about the value of 0, then it may be safe to say the linearity assumption holds. Looking at figure B.1, there is not a clear pattern that emerges among the residuals. A LOWESS line is fitted to the data to give a better picture of the pattern in the data. The LOWESS line is pulled slightly downward toward the lower predicted values. In figures B.2 and B.3, particular countries and years seem to stand out as important, specifically Ethiopia in 1983 and 1985, but neither of these observations is considered an extreme outlier and therefore, I am not concerned that they are driving the relationship in the data very much.

Table B.3 Determinants of Agricultural R&D Spending (with electoral system dummies)

	Model 3	Model 6
Rural Population Density	0.00309***	0.00114
	(4.21)	(1.36)
Civil Society Participation	0.819**	0.851**
	(2.94)	(2.74)
Permanent Cropland (%)	0.0380**	0.00199
	(3.19)	(0.10)
ln(GDP Per Capita)	0.559***	0.391***
	(4.72)	(4.34)
Resource Rich	1.787***	2.004***
	(6.16)	(8.37)
Landlocked	-0.611***	-0.0418
	(-4.98)	(-0.15)
Resource Rich x Landlocked	-1.441***	-2.749***
	(-3.80)	(-5.52)
Political Competition	-0.0422**	-0.0493**
	(-3.27)	(-2.83)
Years in Office	0.00559	0.00386
	(1.67)	(1.20)
Presidential System	-0.299	-0.149
	(-1.69)	(-1.12)
Excluded Population	-0.340	-0.202
	(-1.65)	(-1.08)
Proportional Representation System		-0.507*
		(-1.97)
Mixed Electoral System		-0.571
		(-1.58)
Constant	-1.521	0.348
	(-1.77)	(0.47)
Observations	285	242
R^2	0.86	0.90

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure B.1 Predicted Values vs. Residuals: Agricultural R&D Model

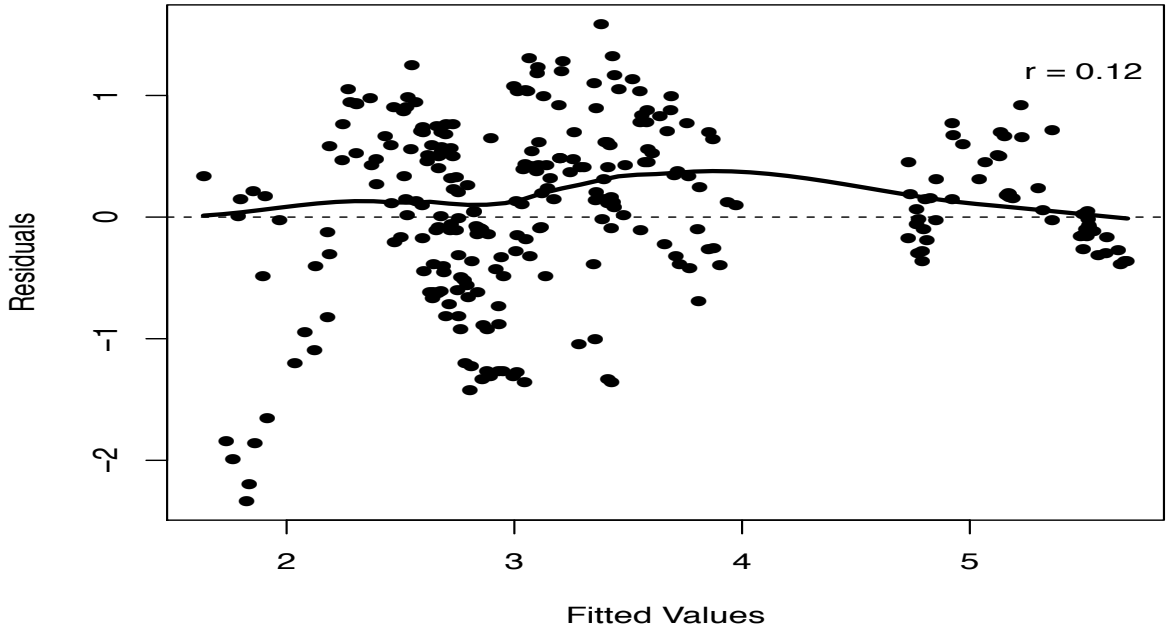


Figure B.2 Predicted Values vs. Residuals: Agricultural R&D Model

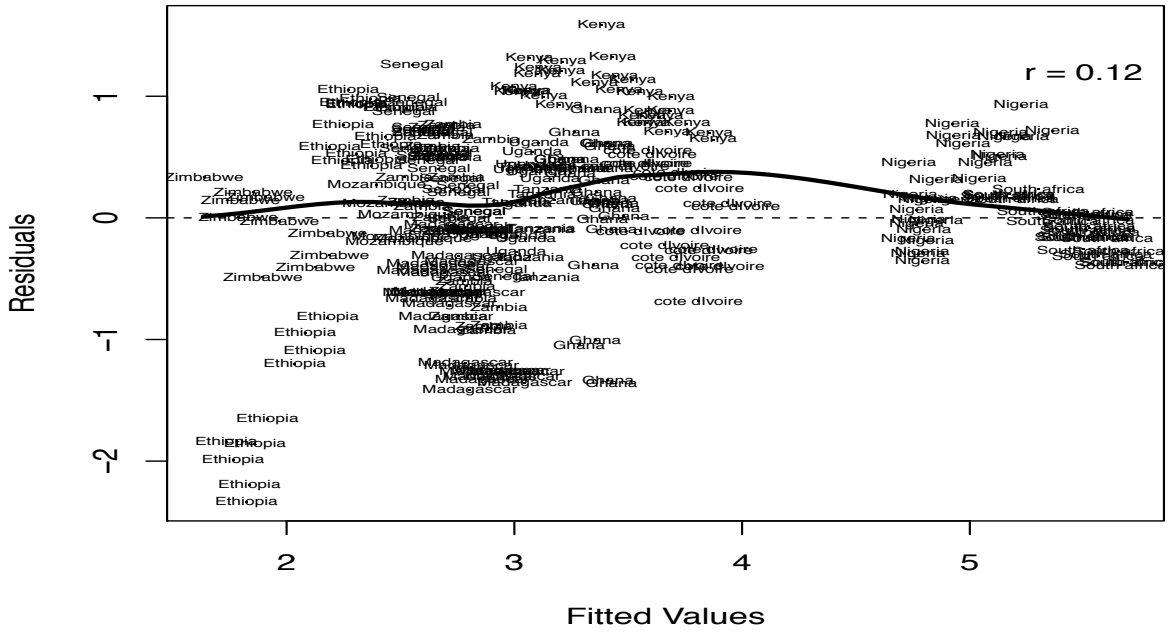
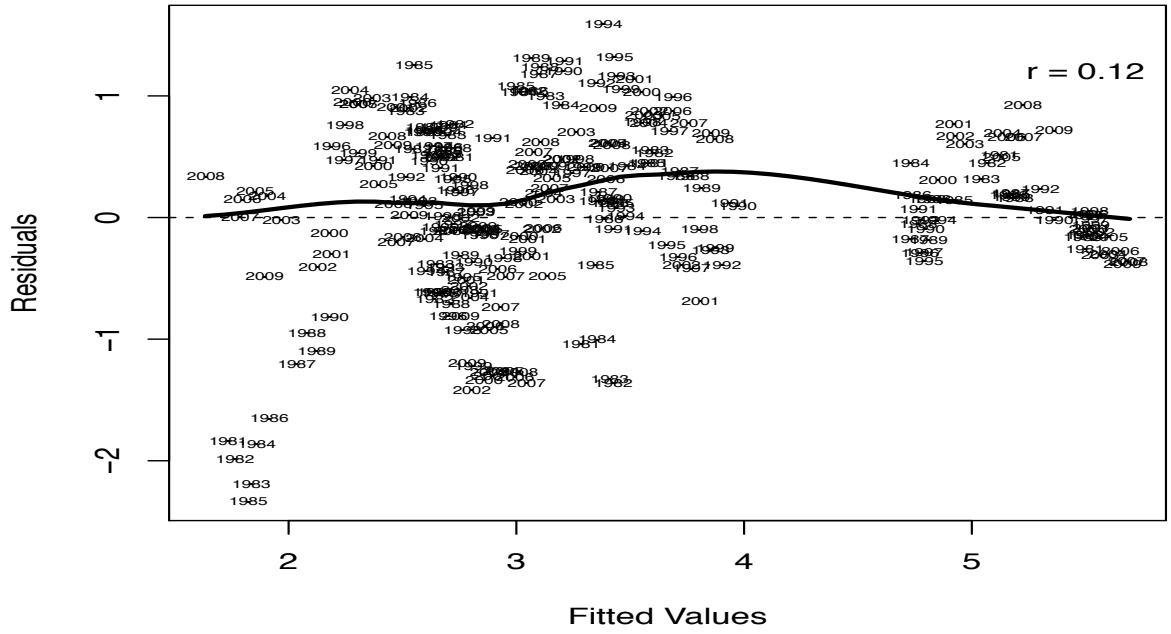


Figure B.3 Predicted Values vs. Residuals: Agricultural R&D Model



B.4 Robustness Checks

In Chapter 5, I estimate a series of panel data models. Two key concerns in those models are the presence of temporal autocorrelation in the residuals of each panel and the potential for non-constant error variances. The models in question estimate Prais-Winsten regressions to address autocorrelation, and utilize panel-corrected standard errors (PCSEs) to address issues with unit-wise heteroscedasticity. An important characteristic of this approach is that, for high estimated values of ρ, Prais-Winsten regression is similar to regression on first-differenced series, in the sense that it relies for the removal of autocorrelation on a unit-wise (partial) difference of Y_{it} and Y_{it-1}. This in turn makes these models similar to "unit effects" models (in particular, fixed-effects models) in that they rely primarily on within-unit variation to estimate effects.

As scholars have noted (Hu et al.1998), there are important differences between such "subject-specific" methods for panel data and "population averaged" models. The latter include models such as generalized estimating equations (GEEs), which rely on a generalized "working" correlation matrix to address temporal and cross-sectional heterogeneity in panel data. In particular, GEE models

with first-order autoregressive errors offer a useful alternative approach to addressing the concerns raised above. Such models address autocorrelation through the "working" correlation matrix, and use robust/sandwich variance-covariance estimators to address unit-wise heteroscedasticity. [1]

As a check on the robustness of the results in Table 5.3, I estimated GEE models of AGRD (both logged and unlogged), using an AR(1) working correlation matrix and robust (Huber/White) standard errors. Those results are presented in Tables B.4 and B.5, alongside the primary results from Table 5.3. The central insight from these analyses is that the findings in Chapter 5 are robust to at least some reasonable alternative model specifications. In this case, the differences in the point estimates of the coefficients are generally slightly attenuated in the GEEs (relative to the models with PCSEs), with correspondingly lower t-statistics. For the most part, however, the substantive findings remain intact. The major exception to this is the importance of *Civil Society Participation* in the logged spending models, which exhibits slight reductions in the estimates of β accompanied by increases in the estimated standard errors (and a corresponding loss of statistical significance). However, the fact that these findings largely persist under even a relatively substantial change in the estimated model provides reassurance that the findings are not a statistical artifact.

[1] In addition, given the subject matter, there are reasons to believe that a population-averaged approach may offer clearer substantive insights into the questions at hand; see Hu et al. 1998, 701.

Table B.4 PCSE vs. GEE Estimation with logged Agricultural R&D Spending

	PCSE	GEE	PCSE	GEE
Rural Population Density	0.00309***	0.00168	0.00343***	0.00154
	(4.21)	(1.51)	(4.35)	(1.46)
Civil Society Participation	0.819**	0.751	0.657*	0.579
	(2.94)	(0.92)	(2.50)	(0.77)
Permanent Cropland (%)	0.0380**	0.0463	0.0297*	0.0389
	(3.19)	(1.52)	(2.34)	(1.28)
ln(GDP Per Capita)	0.559***	0.666**	0.766***	0.640**
	(4.72)	(3.24)	(5.20)	(3.23)
Resource Rich	1.787***	1.632**	1.374***	1.756***
	(6.16)	(3.26)	(3.90)	(3.42)
Landlocked	-0.611***	-0.207	-0.282	0.170
	(-4.98)	(-1.01)	(-1.90)	(0.74)
Resource Rich x Landlocked	-1.441***	-1.796***	-1.283**	-2.181***
	(-3.80)	(-5.48)	(-2.84)	(-5.69)
Political Competition	-0.0422**	-0.0260		
	(-3.27)	(-1.20)		
Years in Office	0.00559	0.00440	0.00606	0.00519
	(1.67)	(1.37)	(1.79)	(1.31)
Presidential System	-0.299	-0.0570	-0.147	0.0381
	(-1.69)	(-0.44)	(-0.77)	(0.87)
Excluded Population	-0.340	0.0361	-0.0863	0.157
	(-1.65)	(0.25)	(-0.55)	(1.00)
Political Competition (alternative)			-0.0665	0.000376
			(-0.90)	(0.01)
Constant	-1.521	-2.149	-3.225**	-2.153
	(-1.77)	(-1.27)	(-3.04)	(-1.28)
Observations	285	285	302	302

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.5 PCSE vs. GEE Estimation with unlogged Agricultural R&D Spending

	PCSE	GEE	PCSE	GEE
Rural Population Density	0.139**	0.137	0.122**	0.129
	(2.82)	(1.71)	(2.97)	(1.73)
Civil Society Participation	-0.990	2.677	-5.387	-2.654
	(-0.08)	(0.23)	(-0.46)	(-0.25)
Permanent Cropland (%)	-0.200	1.994	0.799	1.595
	(-0.17)	(1.22)	(1.09)	(1.05)
ln(GDP Per Capita)	28.24**	23.19	21.80*	21.97
	(2.59)	(1.49)	(2.31)	(1.51)
Resource Rich	171.6**	192.6***	167.0***	193.5***
	(3.21)	(9.78)	(5.52)	(10.03)
Landlocked	-2.890	-10.88	-5.805	-3.216
	(-0.45)	(-1.85)	(-1.54)	(-0.55)
Resource Rich x Landlocked	-178.3***	-186.5***	-164.3***	-191.5***
	(-3.56)	(-9.12)	(-5.74)	(-9.60)
Political Competition	-0.628	-0.471		
	(-0.63)	(-1.04)		
Years in Office	0.0225	0.00633	0.0131	0.0119
	(0.12)	(0.04)	(0.08)	(0.06)
Presidential System	2.335	5.102	3.933	7.550
	(0.20)	(0.77)	(0.50)	(1.79)
Excluded Population	-16.86	-16.06	-9.262	-9.499
	(-0.89)	(-0.83)	(-0.64)	(-0.65)
Political Competition (alternative)			3.730	5.245
			(0.58)	(0.99)
Constant	-185.1*	-162.6	-149.0*	-159.9
	(-2.52)	(-1.39)	(-2.34)	(-1.46)
Observations	285	285	302	302

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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