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The Quality of Governance, Composition of Public Expenditures, and Economic Growth: An Empirical Analysis

Paul Kagundu

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THE QUALITY OF GOVERNANCE, COMPOSITION OF PUBLIC EXPENDITURES, AND ECONOMIC GROWTH: AN EMPIRCAL ANALYSIS

BY

PAUL KAGUNDU

A Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree
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ACCEPTANCE

This dissertation was prepared under the direction of the candidate's Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Economics in the Andrew Young School of Policy Studies of Georgia State University.

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QUALITY OF GOVERNANCE, COMPOSITION OF PUBLIC EXPENDITURES AND ECONOMIC GROWTH: AN EMPIRICAL ANALYSIS.

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This dissertation seeks to analyze, both theoretically and empirically, the impact of quality of governance on growth by looking at various dimensions of the concept of governance. We use a dynamic panel estimator and various indicators of governance to estimate the impact of governance on growth. Our empirical results suggest a positive and statistically significant impact of governance on growth.

The second part of the analysis looks at a possible transmission mechanism of the effect of governance on growth through the composition of expenditures. As such, we estimate a seemingly unrelated regressions (SUR) model with shares of three functional categories of public expenditures – education, health, and defense – in total spending as the dependent variables. We find that high quality governance leads to a higher share of education and health expenditures and a lower share of defense expenditures in total expenditures.

Further, we examine the impact of governance of public capital spending. Our empirical results from this analysis suggest that high quality governance is associated with a smaller share of capital expenditures in total expenditures

CHAPTER I

INTRODUCTION

This dissertation explores the impact of institutional factors on the rate of economic growth and a possible transmission channel through allocation of Public resources. We develop a simple theoretical model that explicitly introduces the quality of governance and the composition of public expenditures into a growth model based on one developed by Devaranjan et al. (1996). We theoretically show that the impact of the quality of governance on the rate of growth could, in part, be transmitted through the composition of public expenditures.

As has been shown by a number of researchers, allocation of public expenditures has an impact on the rate of growth.[1] Therefore, if the quality of governance and institutions impacts the allocation of public expenditures, it impacts the rate of growth indirectly. Our model shows that shares of some expenditure types or functions in total public spending are expected to rise with deterioration in the quality of governance, while shares of other types or functional expenditure categories are expected to fall with a decline in the quality of governance. As we discuss later, these findings could have significant policy implications especially in most developing countries where significant proportions of their populations are living in abject poverty.

Empirically, using several indicators of quality of governance, we estimate the effect of quality of governance on the rate of growth in per capita GDP. To explore the potential transmission channel through the composition of public expenditures, we also estimate the effect of quality of governance on the functional composition of public

[1] This literature is reviewed in the next Chapter.

expenditures. We implement this estimation using a system of three seemingly unrelated regressions (SUR). The first equation estimates the impact of quality of governance on the share of health expenditures in total public expenditures. The second equation estimates the impact of quality of governance on the share of education expenditures in total public expenditures. The third and last equation in the system estimates the impact of quality of governance on the share of defense spending in total public expenditures.

Further, we look at the composition of expenditures by economic characteristics of the expenditure – capital spending versus recurrent expenditures. This classification of expenditures is drawn from the International Monetary Fund's Government Finance Statistics (GFS). Accordingly, we estimate the effect of quality of governance on the share of capital expenditures in total public expenditures as a separate regression model from the functional categories in the SUR system.

Finally, we do a Sub-Saharan Africa sub-sample analysis due to the fact that it is the least developed of the world's continents and has had relatively more political and institutional problems in the post-independence era.

Motivation

For more than a decade now, there has been consensus on the importance of good governance in economic performance. Widespread economic, political, and social problems in developing countries can be attributed, at least in part, to public institutions that are run by corrupt and authoritarian leaders. Such weak institutions are particularly vulnerable to capture by vested interests. These vested interests stand in the way of

reforms that are aimed at promoting economic and political competition, which would in turn eliminate rents extracted by the vested interests. As a result, the state fails to establish appropriate rules and institutions to enforce contracts and protect property rights, which are essential for effective functioning of a market economy. This will likely have negative implications to economic growth and development as will be discussed in later Chapters of the dissertation.

As a result of this apparent link between institutions and growth, international financial organizations notably the IMF, the World Bank and the United Nations have facilitated efforts for reform in developing countries. Aid to developing countries has been conditioned on showing progress in public sector reforms, political reforms in terms of allowing greater civil liberties and political rights, transparency in the budgetary process and accountability in government at the national level.

Our goal in this study is to analyze, both theoretically and empirically, the impact of quality of governance on growth by looking at various dimensions of the concept of governance. As noted above, the second part of our analysis looks at a possible transmission mechanism of the effect of governance on growth through the composition of expenditures.

Pradhan (1996) points out that the World Bank public expenditure reviews have identified public expenditure "imbalances" in developing countries in favor of capital expenditures and wage expenditures. Understanding the factors that contribute to this imbalance in public spending and generally exploring the link between governance and allocation of public expenditures is important for two main reasons: (1) it will contribute to the literature explaining the role of institutional factors in economic development, and

(2) from the policymakers' point of view, if good governance leads to a "better" allocation of public expenditures, then international financial institutions such as the World Bank (WB) and the International Monetary Fund (IMF) as well as bilateral donors should focus their efforts and resources on institutional reforms, enhancing the democratization process and the rule of law in developing countries. This would contribute to a more socially optimal allocation of public resources.

The Need for Theoretical Analysis

There is need to extend the existing theoretical models on institutions and economic performance in order to establish a firm basis for the empirical work done in this dissertation. Recent growth models such as Barro (1990), Barro and Sala-i-Martin (1992), and Palivos and Yip (1995) have extended endogenous growth models to incorporate public finance.[2] These models have primarily examined the role of fiscal policy (Barro 1990) in the growth process. Palivos and Yip (1995) examine the impact of the way government finances its spending (raising taxes versus issuing money) on the growth process. This is a significant contribution to the literature as it highlights the impact of government actions on economic growth. However, these models do not examine the impact of the composition of total government expenditures on the growth process. Devarajan et al. (1996) make this extension by examining how a change in the composition of expenditures impacts the growth process.

The theoretical model we present in Chapter III of this dissertation extends the Devaranjan et al. model, and explicitly recognizes that decisions on allocation of public

[2] See also Rebelo (1991) and Romer (1986)

expenditures are not done by benevolent despots or "social planners" whose primary goal is to maximize social welfare. In other words, we introduce in the model a parameter of quality of governance to capture the rules and constraints within which decision-makers act.

Without an effective incentive mechanism, decision-makers will allocate public resources to maximize their private rents and not the common good. Our model brings together the quality of governance and the composition of public expenditures in a growth model and allows us to analyze a potential transmission mechanism of the impact of governance on economic growth.

The Need for Empirical Analysis

The theoretical analysis links the quality of governance and economic growth, and quality of governance and the composition of public expenditures. To inform policy, there is need for an empirical investigation that will provide quantitative effects of quality of governance on economic growth and on the composition of public expenditures.

A number of cross country studies have used various indicators of governance to study its impact on economic growth.[3] Indicators of democracy (indexes of civil liberties and political rights) are the most widely used indicators of governance. Others are indicators of maintenance of the rule of law and control of corruption. We build on these studies by expanding the set of indicators of quality of governance to include an index of quality of the government bureaucracy, an index of risk of repudiation of government contracts, and an index of the risk of expropriation of private contracts.

[3] See Chapter II for a detailed review of the literature.

In addition, we examine the impact of quality of governance on the composition of public expenditures. The literature on institutional factors and the composition of public expenditures is limited. Most studies do not explicitly control for political/institutional quality. There are however a few studies such as Tanzi and Davoodi (1997), Mauro (1998), and Sturm (2001) that do include some measures of institutional quality such as indicators of corruption, and the political ideology of the political leaders or party in power. Our analysis is within this framework. In the coming chapters, we show how we build on to this existing literature and how we deal with specific empirical issues that we believe have not been effectively addressed in previous studies.

The Sub-Saharan Africa Case

There are a number of reasons for treating Sub-Saharan Africa separately from the more developed regions. Colander (2004) estimates Africa's average annual per capita GDP growth rate for the period 1950-2000 at 0.8 percent compared to 2.4 percent for Asia (excluding Japan and China), 1.4 percent for Latin America, 1.8 percent for North America, and 1.8 percent for the entire world. Other estimates by Ndulu and O'Connell (1999) put the average growth rate in real GDP per worker for the period 1960-1994 at 0.39 percent for a group of Sub-Saharan African countries and at -0.44 percent for the period 1973-1994. This contrasts with 3.14 percent and 1.65 percent respectively for a group of comparable developing countries from other regions.

So, what explains Sub-Saharan Africa's dismal economic performance relative to the rest of the world? A number of factors have been identified in the literature, notably

the geographic location in the warm and disease-infected tropics that affects labor productivity and the colonial heritage that has not helped efforts to build good institutions of governance.[4] This link between Africa's poor economic performance and the quality of political and economic institutions is clear when one observes political and economic events in the region over the past four decades.

As observed by Ndulu and O'Connell (1999), trends in per capita income growth rates in Sub-Saharan Africa indicate rapid growth in the 1960s, declining growth rates in the 1970s and 1980s and marked improvements in the 1990s. This trend coincides with the growth of dictatorships and authoritarian rule in the 1970s and 1980s and the development of relatively more pluralist and democratic rule in the 1990s.

These events suggest a clear link between political or institutional factors and economic growth. Thus, a separate analysis of the Sub-Saharan Africa sample will enable us to gauge whether the adverse effects of poor institutions of governance are greater in magnitude in this region relative to other regions of the world.

Overview of the Dissertation

The rest of the dissertation is organized as follows: Chapter II provides a working definition of governance based on definitions used in earlier research and a brief review of the literature on governance and economic performance. This Chapter also reviews literature on the composition of public expenditures. In Chapter III, we develop a simple theoretical model linking governance, the composition of expenditures and economic

[4] See Acemoglu, et al. (2001)

growth. Chapter IV describes the empirical estimation methods and the data. Chapter V presents and discusses the empirical results. Chapter VI concludes the dissertation.

CHAPTER II

LITERATURE REVIEW

Over the past fifteen years, the literature on governance and its various links to economic performance has burgeoned. This literature is motivated by the apparent correlation between the quality of institutions and differences in standards of living across countries. So, in this Chapter, we provide a survey of some of the main findings emanating from some of these studies. We will discuss measures of governance used in the literature, and highlight some of the difficulties in assessing the economic impact of governance, both theoretically and empirically. Further, we will review some of the studies that focus on causes of differences in institutions across countries.

So, the Chapter layout is as follows. In the first section, we briefly review the various definitions of governance that have been used by researchers in this area. In the second section, we discuss the causes of differences in the quality of institutions. In the third section, we look at the theoretical links between the quality of governance and economic performance as established in the literature. In the fourth section, we highlight the empirical literature on governance, the various measures of governance employed in different studies and the problems encountered in empirically teasing out the impact of governance on measures of economic performance. In this section, we also discuss how our work and methodology expands and improves on existing literature

Finally, the fifth section discusses the link between quality of governance and the composition of public expenditures, and our contribution to this strand of literature.

Defining Governance

While the literature does not provide any single precise definition of the term governance, there seems to be consensus about its dimensions. “Public governance has been associated with how governments are structured, what processes they employ in governing and what results they are able to accomplish in regard to the needs of those that they serve” (Jreisat 2002). These dimensions encompass the organization of social, economic and political systems, allocation of public resources to members of society, and acquisition and exercise of political power, all of which are important for economic and social development of any society.

As discussed by Keefer (2004), the term governance is “very elastic and multi-dimensional.” However, Keefer (2004) also points out that most definitions relate to “the extent to which governments are responsive to citizens and provide them with certain core services, such as protection of property rights, and more generally the rule of law, and the extent to which institutions give government decision makers an incentive to be responsive to citizens.”

Because of the multi-dimensional nature of governance, a number of definitions have emerged in the literature. In 1989, the World Bank defined governance as “the exercise of political power to manage a nation’s affairs.” The African Development Bank (1999) extends the World Bank definition to adapt it to the changing global economy in

the wake of globalization. The AfDB defines governance as "a process referring to the manner in which power is exercised in the management of public affairs of a nation, and its relations with other nations."

It is important to note that the World Bank and AfDB definitions seem to put more emphasis on the effectiveness of governments in delivering services to members of their societies. However, as discussed by Keefer (2004), the broader concept of governance should encompass the incentive structure that governs the actions of the political actors. This is the issue of political and economic systems.

Earlier literature on economic development implicitly assumed that politicians would make decisions that maximize society's welfare. Dethier (1999) makes a point that "governments are not benevolent dictators who seek to maximize social welfare, but complex governance structures characterized by agency relationships." Efficient use of public resources depends not only on institutions (narrowly defined as organizational structures), but also on incentive schemes within public organizations (Dethier 1999).

A broader definition of institutions was offered by North (1990) as "rules of the game in society or, more formally, are the humanly devised constraints that shape human interaction." This broader definition provides for the incentive structure within the decision making mechanism. Another definition that alludes to this more comprehensive view of governance is provided in Kaufman and Kraay (2002).

Kaufmann and Kraay (2002) define governance as the "traditions and institutions by which authority is exercised in a country." According to the authors, this includes the process by which governments are selected, monitored, and replaced; the capacity of the government to formulate and implement sound policies; and the respect of citizens and

the state for institutions that govern economic and social interactions among them. In particular, the process by which governments are selected and monitored greatly impacts the incentive structures within government organizations.

In sum, the effectiveness of governments in delivering services to their populations is clearly not exogenous – it depends on the incentive structure, which in turn depends on the selection and monitoring of key political and other decision makers. As we will discuss later in the Chapter, the multiple dimensions of governance pose serious empirical and theoretical challenges in studying the economic impacts of institutions or quality of governance.

Differences in Political and Economic Institutions across Countries

One important line of inquiry in attempts to understand the economic effects of governance should focus on the causes of differences in institutions across countries. In other words, why do some countries have institutions that tend to be relatively inefficient in regard to the provision of services to their citizens compared to other countries? Why is corruption rampant in some countries and not in others? Why do we observe differences in bureaucratic delays, protection of property rights, etc, across countries? Recent literature in the area of economic development has attempted to answer some of these questions. This section provides a brief review of some of this literature.

La Porta et al. (1999) discusses the role of colonial origins in explaining current institutional differences. The authors observe that former British colonies have developed better institutions that protect rights compared to former French, Portuguese, or Spanish

colonies. Their findings are supported by other authors who find that British colonies who have adopted common law legal systems (as opposed to the French codified civil law) have better economic institutions (Landes 1998).[5]

Acemoglu, et al. (2001) employ a variant of this link between colonization and current institutions or institutional quality. They look at "conditions in the colonies" rather than the colonizer.[6] The argument is that current institutions are a result of the type of colonization – *settler* versus *extraction*. Settler colonies are those where the European colonizers established settlements such as Australia, Canada, United States of America, and New Zealand. On the other hand, extraction colonies are those where the colonial powers extracted raw materials without establishing permanent settlements.

Acemoglu et al. (2001) attribute the choice of type of colonialism to conditions in the colonies, which can be observed from the European settler mortality. Where settler mortality was high, extraction type colonies were established. So, institutions for the protection of property rights were not put in place. On the other hand, settler colonies were characterized by institutions to protect property rights. The authors further argue that this explains differences in current institutions because institutional quality tend to persist.

Ndulu and O'Connell (1999) also point to historical reasons as a plausible explanation for Sub-Saharan Africa's poor political institutions. Beyond the colonial rule, they discuss the post colonial epoch that was characterized by civilian authoritarian rule in the 1960s and 1970s.[7] This was followed by military dictatorships in the 1980s. They

[5] See also Beck, Demirguc-Kunt, and Levine (2002)
[6] See also Acemoglu, Johnson, and Robinson (2004)
[7] See also Mamdani (1996)

further argue that the adverse effects of these successive political events were amplified by the impact of the cold war that resulted into "a fight for ideological control by the major powers of the war" – the United States and the Soviet Union. This may, at least in part, explain the current state of institutional development in these countries, and therefore the level of economic performance.

The significance of the post colonial political events in Sub-Saharan Africa and Latin America, characterized by neo-patrimonial rule, can be related to the "social conflict view" articulated in Acemoglu, et al. (2004) . According to this view, institutions are chosen by those who control political power. The chosen institutions will therefore be those that maximize the welfare of the politically powerful group and not society as a whole.

However, we should note that, in the context of the discussion on post colonial rule in Sub-Saharan Africa and Latin America, the emergence of neo-patrimonial rule is believed to be a direct result of colonial institutions set to maximize the welfare of colonial masters – a form of the "social conflict view." Acemoglu, et al. (2004) also discusses a number of other plausible reasons for differences in institutions across countries. One of these reasons is what they called the "ideology view," where well-intentioned political actors disagree on what institutions are good for their society. Due to this uncertainty, "those societies that turn out to be right ex-post are the ones that prosper."

A number of other authors have linked institutional quality to variables like ethno-linguistic fractionalization (La Porta et al. 1999; Mauro 1995). Empirically, ethnic fragmentation is commonly measured by the probability that any two randomly picked

citizens belong to different ethnic groups. The hypothesis here is that highly fractionalized societies will have poor institutions. What could be the reason for this? One plausible answer to this question is that such societies are far less likely to agree on any one set of institutions compared to more homogeneous societies. The second possible explanation for this observation is that social conflicts are far more likely in ethnically fragmented societies, and the politically strong groups will set up institutions to maximize their own group welfare.[8]

Further, La Porta et al. (1999) find that countries that are poor and or have a high proportion of Catholics or Muslims are associated with inferior government performance. They measure government performance using measures of government intervention (protection of property rights, business regulation, and taxation), efficiency of government (bureaucratic delays, corruption, etc), output of public goods, and the size of the public sector. The negative impact of catholic and Islam, they argue, could result from "the use of religion for political purposes in Muslim and Catholic countries, and the destructive competition between church and State in Catholic countries in particular." Such competition may have led to policies that are not conducive for the market to operate efficiently.

Geography (altitude and climate) has also been linked to the quality of institutions. Again, La Porta, et al. (1999) find that countries that are closer to the equator exhibit inferior governments. One argument for this relationship, presented in Hall (1999), relates latitude to "Western Influence," which leads to better institutions. However, the drawback in this argument, is that geography (measured as closeness to the equator) may have a direct impact on per capita income, which in turn impacts

[8] This is the "social conflict view" discussed in Acemoglu, et al. (2004)

institutional quality (Acemoglu, Johnson, and Robinson 2001; Bloom et al. 1998). Warm climate may be associated with lower productivity, and thus, lower incomes. Since affluent societies are associated with superior institutions, the effect of geography on institutional quality may actually be transmitted through income instead of closeness to "Western Influence" as argued by Hall and Jones (1999).

Lastly, Knack (2000) examines the impact of aid dependence on the quality of governance. He finds that "aid dependence undermines institutional quality by weakening accountability, encouraging rent-seeking and corruption, fomenting conflict over control of aid funds, siphoning off scarce talent from the bureaucracy, and alleviating pressures to reform inefficient policies and institutions." Although these findings are plausible, there might be sample selection issues in the sense that aid-dependent countries are normally poor and with inferior institutions. Knack (2000) tackles the potential reverse causality issue by instrumenting aid using infant mortality in 1980, and initial GDP per capita.

Theory of Institutions and Economic Performance

Although detailed research on the role of public governance in economic growth and development is fairly recent, the importance of good governance was recognized centuries ago as demonstrated in the following quote taken from one of Adam Smith's lectures.

"Little else is requisite to carry a state to the highest degree of opulence from the lowest barbarism but peace, easy taxes, and a tolerable administration of justice: all the rest being brought about by the natural course of things (1755)."[9]

This long-recognized link did not take center-stage in the study of economic development until about fifteen years ago, when the correlation between institutional quality and economic performance became more apparent as demonstrated by Ndulu and O'Connell (1999) for the case of Sub-Saharan Africa. They observe that authoritarianism is closely associated with poor economic performance. Good governance that allows for participation of the citizens in the political process and the general running of public affairs may be associated with a feeling of empowerment, which in turn may enhance productivity.

In his Nobel Prize lecture, James Buchanan (1986) argued that economists should look at the "constitution of economic polity to examine the rules and the constraints within which political agents act." He implicitly suggests that institutions are not developed when their benefit exceeds the cost from the view point of the "common good."

In an attempt to answer the question of why some countries have institutions that tend to retard economic growth, a great number of authors have examined the link between political structures/institutions, economic institutions and economic performance. Political theories suggest that institutions are shaped by those in power to transfer resources to themselves (Acemoglu, Johnson, and Robinson 2004; La Porta et al. 1999). Acemoglu, et al. (2004) argue that groups with different interests will prefer

[9] Lecture in 1755 (accessed in January 2006 at the Adam Smith Institute website: http://www.adamsmith.org/smith/quotes.htm#jump1).

different institutions, and the group that has more political power will ultimately decide on what institutions will prevail.

The question we seek to examine in this section is how these institutions impact economic outcomes. One of the answers could be the rent-seeking and state capture hypothesis. According to this hypothesis, the politically powerful elite, whose interests might be at odds with that of the general public, will engage in rent-seeking activities. As such, they will not be willing to change the status quo.

As we will see later in this dissertation, rent-seeking and the quest to protect future rents, may lead to inefficient allocation of resources from the social welfare perspective. Further, resources are devoted to wasteful rent-seeking activities instead of productive activities (Kimenyi and Tollison 1999).

Dethier (1999) argues that the "efficiency of the use of public resources depends on incentive schemes of public organizations and that reform should focus on designing schemes that ensure credible commitment and implementation of policies that maximize social welfare." Good governance improves human capital and efficiency in the use of resources, which in turn enhances economic growth (Dethier 1999).

Political institutions design the legal system that defines the rules that govern exchange. In a political process, different interest groups compete for political power or economic rents within the framework of the rules defined by the legal system. Without an appropriate incentive structure within political institutions, rules may be designed to benefit particular groups with a political advantage at the expense of society as a whole.

Without basic legal protections – say of property rights, and against government expropriation of private property, private investment growth is bound to decline and so

will be per capita income growth. Private investment, especially foreign investment, is also discouraged by poor quality bureaucracies that are susceptible to capture by interest groups. This will in turn retard economic growth.

As far as democracy effects of growth are concerned, there seems to be no conceptual or theoretical agreement on the nature and direction of the effect. In a democratic political process, interest groups pressure policymakers to pursue policies that favor these particular groups often at the expense of the general good if this enhances their chance of retaining power through re-election. On the other hand, dictatorships may pursue policies that favor interest groups that maintain them in power, and thus protect their future rents. So, since no government is insulated from pressure from interest groups, the question of which political regime will foster the rule of law, and economic growth is theoretically unclear (Przeworski and Limogi 1993).

The Empirical Literature

As noted in the preceding section, theoretical studies do not offer unambiguous answers to the question of whether good governance leads to better economic outcomes. The specific case described above relates to the role of democratic institutions in economic development. The theoretical literature provides evidence that democracies as well as dictatorships are subject to pressure from rent-seeking interest groups. In either case, rent-seeking impedes efficient allocation of resources, and may retard productivity growth as more time and other productive resources are directed toward rent-seeking activities.

Further, as pointed out in earlier, governance is a multi-dimension concept that encompasses the organization of social, economic, and political systems. For this reason, it is reasonable to suspect that different dimensions of governance might have different impacts on economic development. These limitations of theoretical analyses call for empirical analyses as a complement not a substitute to theoretical analyses. So, in the discussion that follows, we will explore some of the empirical work that has been done in this area and the limitations or common problems encountered in these and similar studies.

A big challenge in any empirical studies aimed at examining the impact of governance is quantifying governance. Indeed, there is no perfect measure of quality of governance. Numerous empirical studies have employed different subjective indicators of governance that are based on various perception indexes. In some cases, objective proxies (such as number of revolutions, political assassinations, democratic elections, etc) have been used. A portion of the literature has focused on studying the impact of political and institutional variables on levels of real per capita GDP, and a number of studies, on economic growth.

The most frequently studied question is the role of democracy in economic development. Most of the recent work has used indicators of political rights and civil liberties compiled by Freedom House to measure the extent of democratization.[10] Other authors such as Barro (1991) have used measures of political instability and political violence to study the impact of political variables on economic growth. Such proxies

[10] Indexes of Political rights and civil liberties are published as "Freedom in the world country scores" by Freedom house for a relatively big number of countries.
See http://www.freedomhouse.org/reseach/freeworld/2003/methodology.htm for details on the methodology.

include the number of revolutions and military coups, and the number of political assassinations.

Some authors have focused on measures of objective policy volatility. These measures are based on the standard deviation of variables such as tax rates, monetary variables and trade distortions as proxies for an uncertain policy framework (Kormedi and Meguire 1985).

The other commonly used source of governance data is the International Country Risk Guide (ICRG) compiled by the Political Risk Services (PRS) group. The PRS group is a commercial service that provides financial, economic and political risk assessment for investors. The data consists of indicators of the risk of repudiation of contracts by government, risk of expropriation of private investment, corruption in government, rule of law, quality of bureaucracy, and ethnic tensions (Acemoglu, Johnson, and Robinson 2001; Knack and Keefer 1995).

Kaufmann and Kraay (2002) compute six aggregate indicators of governance from various perception indexes based on the various dimensions of governance. The aggregate indicators are: (a) Voice and accountability, which measures citizens' involvement in the selection of governments. (b) Political stability, which measures the likelihood of the government in power being destabilized or overthrown through unconstitutional means. (c) Government effectiveness, which combines perceptions of the quality of public services, the quality of the bureaucracy, etc. (d) Regulatory quality, which includes measures of incidence of "market-unfriendly" policies. (e) Rule of law, which measures the extent to which agents abide by the rules of society. (f) Control of

Corruption, which measures perceptions of corruption – defined as exercise of public power for private gain.

Other studies have employed various individual indicators of quality of governance. La Porta, et al. (1999) measures government performance using indexes of government intervention into the market, which includes the property rights index (the degree of legal protection of private property), and the business regulation index (regulations relating to opening a business and keeping it open); government efficiency, which includes measures of corruption, bureaucratic delays (red tape), tax compliance, and the ratio of average government wages to GDP per capita; output of public goods, which is measured by infant mortality, school attainment, literacy rates, and quality of infrastructure; size of the public sector, which includes measures of the government transfers and subsidies, government consumption, and an index of State-owned enterprises.

Subjective measures, which are based on perceptions, are far from perfect. They are subject to bias errors, and makes comparisons across time meaningful only when the surveying methodology is the same across time. We think that some of the measures of quality of governance used in La Porta, et al. (1999) may be misleading as they might be measuring the quality of specific policies rather than the quality of governance in a broad sense. An example is Cuba, with high literacy rates and an undemocratic system of governance. This may have something to do with specific policies and not overall quality of governance.

Given that the quality of governance is not measurable, empirical researchers have no choice but to use indicators rather that actual measures of governance. However,

indicators are prone to bias errors, which in turn may lead to biased empirical estimates (Dethier 1999) . As such, results from any such empirical studies should be interpreted with this drawback in mind.

Even if we assume that the indicators used are accurate measures of quality of governance, there are still other empirical issues a researcher has to deal with. First, as discussed in Dethier (1999), we cannot be sure that the measured effect of governance on measures of economic performance is direct first order effect or second order or third order. This calls for a deeper examination of potential channels through which the quality of governance impacts economic performance. In our case, we will examine the impact of governance on the composition of public expenditures as one plausible channel.

Isham, Kaufmann, and Pritchett (1997), using data from the World Bank's Operations Evaluation Department (OED), looked at the performance of Government projects. They concluded that increased citizen voice and public accountability (enhanced by civil liberties and democracy) results into greater efficacy in public action.

Further, empirical work studying the economic impacts of governance may be faced with endogeneity problems. In other words unobserved factors that influence economic performance may be correlated with indicators of governance. Unobserved random shocks like unexpected military coups may affect both economic performance and the quality of governance. Various studies have implemented instrumental variables approach to deal with this problem (Acemoglu, Johnson, and Robinson 2001; Barro 1997; Levin and Renelt 1992). However, the big challenge with instrumental variables estimation is obtaining valid instruments for quality of governance. Among the various instruments used for institutional factors are measures of ethno-linguistic fragmentation

in Mauro (1995) to instrument for corruption. However, if ethno-linguistic fractionalization has a direct impact on economic performance, then it is not a valid instrument for institutional factors in the growth equation.

As noted earlier, Hall and Jones (1999) use distance from the equator to instrument for social infrastructure, arguing that latitude measures closeness to "western influence" and thus better institutions. Acemoglu, et al. (2001) argues that these instruments are invalid due to their direct impact on economic performance. So to study the impact of institutional factors on levels of per capita GDP, they use European settler mortality rates during the colonial era as an instrument for institutional quality. They argue that the nature of institutions set up by the colonizers depended on whether they could settle in the colonies or not. The decision to settle depended on the conditions in the colony. Since institutions persist, they argue, settler colonies have better institutions. They conclude that "once institutional quality is controlled for, countries closer to the equator do not have lower incomes."

Barro (1997) conducts a cross-country empirical study on the determinants of growth. Two institutional factors – an index of democracy and an index of the rule of law are used in the Barro (1997) study. The Democracy index used is the political rights index compiled by "Freedom House." The index measures the extent to which citizens can participate meaningfully in the political process. The study concludes that there is a nonlinear causal relation running from democracy to economic growth. This suggests that "democracy raises growth when political freedoms are very low, but reduces growth after a certain optimal level of freedom is reached." The rule of law index used in Barro (1997) is compiled by the Political Risk Services (PRS) and distributed as the

International Country Risk Guide (ICRG). The rule of law index is found to have a positive and statistically significant causal effect on growth.

Another empirical problem related to the endogeneity of institutional variables, especially in per capita growth regression equations as well as regressions of levels of GDP per capita is simultaneity. Various studies have found evidence of reverse causality running from economic performance to institutional measures such as democracy and the rule of law (Chong and Calderon 2000; Kaufman and Kraay 2002b).

In particular, Kaufman and Kraay (2002b) find a strong and positive correlation between per capita income and the quality of governance. Their empirical analysis break this correlation into: 1) a strong positive causal effect running from better governance to higher per capita incomes, and 2) a weak and negative causal relationship running from per capita income to governance. They attribute the negative causal relation running from per capita incomes to governance to "elite influence and state capture, which becomes more prevalent as the country grows." Kaufmann and Kraay (2002b), however, look at levels of per capital income as opposed to growth. Their measures of governance are the aggregate governance indicators compiled by the authors themselves.

Chong and Calderon (2000) on the other hand suggest that economic growth enhances institutional quality by providing more resources to improve existing institutions and their efficiency. Burkhart and Lewis-Beck (1994) use data consisting of a pooled time series data set on 131 nations for the period 1972-1989. Their Granger causality tests indicate that "economic development "causes" democracy but democracy does not "cause" economic development." This result is contrary to the conclusions of

Barro (1997), and Rivera-Batiz (2002) who find some positive growth effects of democracy.

Rivera-Batiz (2002) argue that governance-improving democracy raises growth through constraining actions of corrupt officials, which in turn stimulates technological change and spurs economic growth. His empirical evidence suggests that democracy is a significant factor in increasing total factor productivity growth between 1960 and 1990 in a cross section of countries.

Some studies have focused on corruption as a proxy for quality of governance. "Corruption, viewed in a broader governance framework, thrives when the state is unable to reign over its bureaucracy, to protect property and contractual rights, or provide institutions that enforce the rule of law" (Hellman et al. 2000).

Earlier literature on the question of corruption and economic growth seemed to support the view that corruption may enhance growth. This view is based on the argument that corruption helps remove government-imposed rigidities.[11] The more recent literature, on the other hand, has provided evidence of negative growth effects of corruption (Murphy, Shleifer, and Vishny 1991).

These studies argue that corruption enhances fiscal deficits and constrains government's to impose appropriate regulatory controls that are aimed at correcting market failures. Further, corruption distorts incentives in the sense that individuals spend their time and energies on rent seeking and corrupt activities as opposed to productive activities.

The above literature, for the most part, establishes a direct and positive link between governance and economic growth. The positive causal relationship running from

[11] See Leff (1964) and Huntington (1968).

governance to economic growth could be attributed to constraints and limitations placed on the actions of potentially corrupt officials, and to a feeling of empowerment and participation that is believed to increase productivity.

However, we notice from the literature that conclusions from various studies vary substantially, and the question of the direction of causation is not quite settled. We also note that the relationship between governance and economic growth may be nonlinear as suggested by Barro (1997).

The empirical study that we propose employs various indicators of governance as opposed to the indicators of democracy and rule of law alone. We will analyze growth effects of governance as opposed to analyzing levels of per capita income as in Kaufmann and Kraay (2002b).[12]

In addition to the direct impact of governance on economic growth, some studies have attempted to examine indirect growth effects of governance. It is argued that institutional factors exert indirect growth effects through other variables such as capital flows, business investment decisions, and trade policy.

Batra et al. (2003) utilize a set of enterprise data based on a survey of more than 10,000 firms to conclude that, among other factors, "the quality of governance matter significantly in explaining a firm's performance and investment behavior." This finding agrees with that of Oliva and Rivera-Batiz (2002), who find indirect growth effects of some institutional variables. Based on data on 119 developing countries for the period 1970 through 1994, they estimate a system of growth, FDI and schooling equations. The results from a three-stage least squares (3SLS) estimation suggest that the rule of law

[12] More on this is in the empirical Chapters of the dissertation

impacts economic growth through encouraging FDI and democracy impacts economic growth through encouraging schooling.

In this study, we hypothesize that institutional factors affect economic growth through the composition of public expenditures. Thus, we will show that the quality of governance affects the composition of public expenditures, which potentially affects per capita income growth rates.

Further, most studies on economic performance and institutional factors have been cross-section studies. We employ panel data methods in our analysis, which expands our sample information.

Governance and Composition of Public Expenditures

As indicated in the above survey, the literature on governance, and its impact on economic performance, is broad and growing. However, most of the existing empirical studies have focused on the total impact of governance on economic growth.[13] In recent years, a new strand of literature in this area has emerged. This new strand seeks to explore the possible channels through which the quality of governance or institutions impacts economic performance.

For instance, Isham, Kaufmann, and Pritchett (1997), using data from the World Bank's Operations evaluation Department (OED), looked at the performance of Government projects. They concluded that "increased citizen voice and public accountability results into greater efficacy in public action." It is also argued that

[13] See for example Barro (1997), Campos and Nugent (1999), Rodrik, et al. (2002), Nkurunziza and Bates (2003), Acemoglu, et al. (2001), Acemoglu et al. (2004)

institutional factors exert indirect growth effects through other variables such as capital flows, business investment decisions, and trade policy (Batra, Kaufmann, and Stone 2003).

Gyimah-Brempong (2002), using a sample of African countries and corruption to proxy for institutional quality, finds that corruption affects economic growth indirectly through decreased investment in physical capital and in education. He also finds corruption to be positively correlated with income inequality.

One of our goals in this study is to explore the impact of governance on allocation of public expenditures. We believe that institutions and regulations that determine the incentive structure in which economic agents operate affect allocation of public resources. Our interest in this relationship is motivated, in part, by a number of studies that find a significant effect of levels and composition of public expenditures on economic growth (Barro and Sala-i-Martin 1992; Barro 1990; Bose, Haque, and Osborn 2003; Devaranjan, Swaroop, and Zou 1996).

Further, as noted in Chapter I, the World Bank Public Expenditure Reviews (PERs) have identified patterns of "spending imbalances" in developing countries that indicate a bias toward new capital investments, under-funding of non-wage operations and maintenance, and overstaffed civil service. So, our interest is to find out if these patterns are related to the country's institutional quality, and try to explain how this relationship might arise.

Dethier (1999) suggests that in the absence of good institutions, agents will likely exploit discretionary power to misappropriate public resources for private gain. Theories of rent-seeking (and rent extraction) and state capture by the elite are going to be our

central link between the quality of governance and the composition of public expenditures. Rent-seeking is defined as the "expenditure of scarce resources to capture wealth transfers" (Buchanan 1980).

For the purposes of this study, rent-seeking would refer to expending resources to influence public spending allocation. The extent of rent-seeking and the actual rents extracted will depend on how vulnerable public institutions are to pressure from various interest groups (Kimenyi and Tollison 1999). Strong institutions are less likely to "fall prey" to pressures from firms or other interest groups (Pradhan 1996). Most rent-seeking theories in public choice literature focus on western democratic systems. However, the story might be different with autocratic regimes.

Rowley (1999), using examples of Kenya, Nigeria, Ghana, and the Democratic Republic of Congo (formerly Zaire), discusses rent-seeking and rent extraction in Africa. He traces the problem to colonial systems that were highly centralized and which were maintained in the post-colonial structures. The colonial legacy had led to the so-called "African socialism" with overreaching state control of the economy. Rent extraction policies practiced in most countries included price and interest rate controls, regulation of foreign exchange markets, import licensing, and selective taxation and subsidization schemes (Rowley 1999).

Rowley further argues that these controls, coupled with the lack of constitutionally guaranteed property rights, provided fertile ground for rent-extraction. The implication of all this to allocation of public resources is that, we are likely to see more spending on subsidies to government controlled corporations as a way of rewarding the leader's "inner circle."

Further, rent extraction is expected to lead to a bias in spending allocation in favor of large capital projects as they may offer large rent-extraction opportunities. Rent-seeking could explain the existence of "market-unfriendly" policies such as trade and foreign exchange regulations that have led to too much government in the market and a big and poorly paid civil service. This implies that in countries where such policies are instituted, we are likely to see bigger bureaucracies and more public spending on wages and salaries relative to other recurrent expenditures. Moreover, Kimenyi (1987) finds that the size of the civil service increases with dictatorship.

The four African countries - Nigeria, Kenya, Ghana, and The Democratic Republic of Congo - studied by Rowley (1999) were all found to have relatively low levels of economic freedom based on indexes used in earlier studies.[14] Political leaders in these countries were associated with high levels of corruption – which took the form of rent-extraction and even outright embezzlement.

A majority of studies on public expenditure have focused mainly on total expenditures (Dudley and Montmarquette 1992; Preston and Ridge 1995; Ravallion 1982; Singh and Sahni 1984; Sinha 1998) and on individual components of public expenditures (Gupta, Mello, and Sharan 2001; Sylwester 2000). However, a number of other empirical studies have looked at the composition of expenditures (Arze Del Granado, Martinez-Vazquez, and McNab 2005; Bose, Haque, and Osborn 2003; Fan and Rao 2003; Mauro 1998; Sanz and Velázquez 2002; Sturm 2001; Tanzi and Davoodi 1997; Yildirim and Sezgin 2002). Our contribution in this study is to this strand of literature that examines the composition of public expenditures.

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[14] Gwartney, et al. (1996); and a survey by Johnson, et al. (1998) . These resources are cited in Rowley (1999) and have not been independently reviewed by the author.

Arze, et al. (2005) examines the effect of fiscal decentralization on the functional composition of expenditures. Specifically, they examine expenditures on health and education, and do not explicitly control for institutional differences across countries. Our improvement to Arze et al. is that we control for institutional differences and we use more disaggregated expenditures. In other words, we examine education and health expenditures separately.

Sanz and Valazquez (2002) also do not explicitly control for differences in institutional differences. They include country dummies to capture these effects. However, given that their sample includes only OECD member countries, institutional quality may not vary much across these countries.

Yildirim and Sezgin (2002), examine growth rates in education, health and defense expenditures in Turkey for the period 1924-96. The main findings of their study is that there are trade-offs between defense and welfare spending (health and education). However, they too, did not control for institutional factors.

Fan and Rao (2003) examined both total expenditures and composition of public expenditures using a sample of only developing countries. They estimate individual equations for the various expenditure functions by region.[15] They include a dummy variable for structural adjustment programs, a one-year lag of government expenditure, and a one-year lag of GDP per capita. Like Sanz and Valazquez (2002), they use country dummies to capture the effect of other determinants of the composition of public expenditures. Their main findings were that structural adjustment programs increased

[15] Expenditure components include agriculture, education, health, social security, transportation and communication, and defense. The regions are Africa, Asia, and Latin America.

spending "on agriculture, education, and infrastructure in Africa; on agriculture and health in Asia; and on education and infrastructure in Latin America"

Mauro (1998) finds that corruption reduces expenditures on education. He argues that corrupt officials will choose to spend public resources on activities with greater opportunities to extract bribes. Most spending on education (salaries, school materials, etc) is clear-cut and does not allow government officials a great deal of discretion. Thus, corrupt officials will design expenditure patterns that provide less spending in these categories, and more spending on categories such as defense and big capital projects. However, Mauro's empirical work does not support the hypothesis that more corruption leads to more spending on defense and public investment.

Tanzi and Davoodi (1997), on the other hand, find that "higher corruption is associated with higher public investment, lower government revenues, lower expenditures on operations and maintenance, and lower quality of public infrastructure. They argue that corruption is likely to increase the number of large and more complex public investment projects. This argument is in line with the rent-seeking hypothesis discussed above. The main idea is that more complex expenditures cannot be easily scrutinized by the media and the public in general and thus provides better opportunities to extract rents in form of inappropriate commissions and bribes. The same argument holds for defense spending which is usually shielded from public scrutiny allegedly for "security reasons" (Gupta, Mello, and Sharan 2001).

Sturm (2001) employs panel data methods to explore the determinants of public capital spending in less-developed countries. The study includes political and institutional variables such as ideology, political cohesion, and political stability. The author finds no

statistically significant impact of politico-institutional variables on public capital spending.

We improve upon the studies surveyed above in a couple of ways. First, following Yildirim and Sezgin (2002), we examine the functional composition of expenditures using use the Zellner (1962) seemingly unrelated regressions (SUR) approach. In other words, we allow contemporaneous errors to be correlated across equations.[16] However, unlike Yildirim and Sezgin (2002), we examine the expenditure composition both across countries and over time. Second, except for Sturm (2001), Tanzi and Davoodi (1997), Mauro (1998), and Gupta et al. (2001), most of the studies surveyed above do not explicitly control for institutional differences.

Finally, following Papke and Wooldridge (1996) and Arze et al. (2005) we employ quasi-maximum likelihood methods and a log-odds ratio transformation approach to empirically deal with the fractional dependent variables in our estimations.[17]

[16] See Chapter IV for details.
[17] See Chapter IV for details.

CHAPTER III

THE THEORETICAL MODEL

In this Chapter we attempt to theoretically show a relationship between the quality of governance and economic growth. We show that the overall impact of quality of governance on economic growth is split between the "direct effect" and the "indirect effect" through the composition of public spending[18].

The model that we present is a representative agent model based on one developed by Devaranjan, et al. (1996). The Devaranjan et al. model develops a link between the composition of public expenditures and economic growth, and defines "productive" and "unproductive" expenditures based on their effects on long-term growth rates. In their framework, an expenditure is productive if it increases the long term economic growth rate in per capita income. Devaranjan, et al. (1996) however, assumes the composition of public expenditures to be exogenously determined by policy.

We modify the model in two ways: 1) we introduce the quality of governance in the production function as an efficiency-enhancing parameter, together with a technology term, and 2) the composition of public expenditures is assumed to depend on the quality of governance.

We do recognize that government allocates expenditures to achieve various goals. Economic growth may just be one of them. As Pradhan (1996) argues, "aggregate

[18] We use "direct effect" to mean the effect of governance on economic growth that is transmitted through channels other than the composition of public expenditures. "Indirect effect" will, henceforth refer to the effect of governance on economic growth that is transmitted through the composition of public spending.

spending should be allocated within and across sectors to maximize social welfare, including the impact on the poor." Indeed, there are expenditures that may increase social welfare without any direct impact on the rate of economic growth. Such expenditures include public spending on museums, leisure parks, theatres, sports activities, religious activities, etc. Analytically, however, measuring social welfare is complicated. It's even much harder in a cross-country study involving countries with diverse preferences. Economic growth is preferred in this study because it is easy to measure relative to other goals of government and is comparable across countries. Thus, the assumption in this study is that economic growth is welfare-enhancing.

The Behavior of Production Units

Per person production (y) in this model takes the form of a Cobb Douglas production function, composed of private capital (k), two types of government expenditures - g_1 and g_2, and a composite efficiency-enhancing term, V , as expressed in equation (3.1) below:[19]

$$y = Vf(k, g_1, g_2) = Vk^{\alpha} g_1^{\beta} g_2^{\gamma} \qquad (3.1)$$

Where: $\alpha, \beta, \gamma \geq 0$; $\alpha + \beta + \gamma = 1$; and following Martinez and McNab (2005), we define $V = A\psi$ as a product of technology, A, and a measure of quality of governance, ψ.

The parameters, α, β, and γ represent elasticities of output with respect to k, g_1, and g_2 respectively. We should also note that we use a broad definition of private capital that includes both physical and human capital (Devaranjan, Swaroop, and Zou 1996).

[19] Deveranjan, Swaroop, and Zou (1996) use a CES specification for the production function.

We also follow Devaranjan et al. (1996) in abstracting from issues of financing public spending by assuming that the government runs a balanced budget. That is,

$$\tau y = g_1 + g_2 = g \tag{3.2}$$

Where g is total government spending per person, and τ is the tax rate.

Let $\varphi = \varphi(\psi)$ be the proportion of g spent on g_1, then:

$$g_1 = \varphi g \text{ and } g_2 = (1-\varphi)g \text{ .Where } 0 < \varphi < 1 \text{ .} \tag{3.3}$$

There is, however, a drawback with the use of the Cobb Douglas specification of the production function. The share of total expenditures spent on any particular function or type cannot be 0 or 1. This is because output per person, y would collapse to 0 with φ = 0 or φ = 1. We, nonetheless, choose the Cobb Douglas specification due to its tractability.

Consumption Behavior

The problem of the representative individual (given the government's decision on τ, and φ) is to maximize lifetime utility:

$$\text{U} = \int_0^{\infty} u(c)e^{-\rho t}\,dt \text{ ; where } u' > 0,\ u'' < 0 \tag{3.4}$$

Subject to:

$$\dot{k} = (1-\tau)y - c \tag{3.5}$$

Where c is consumption per person, k and y are as given in equation (3.1). In equation (3.4), $u(c)$ is the representative individual's instantaneous utility and ρ is the discount rate. A higher ρ implies that the individual values current consumption more than future

consumption.[20] Further, the first and second order derivatives of $u(c)$ with respect to current consumption (in equation 3.4) imply that the marginal utility of current consumption is increasing at a decreasing rate.

The budget constraint in equation 3.5 indicates that, at any one time, the individual divides his/her disposable income between consumption and savings. Thus the rate of change in the capital stock (equal to savings in a closed economy) with respect to time (denoted by $\dot{k}$) is simply the difference between disposable income ($(1-\tau)y$) and current consumption (c). Substituting equations 3.1 and 3.3 into 3.5 yields the following budget constraint:

$$\dot{k} = (1-\tau)Vk^{\alpha}(\varphi g)^{\beta}((1-\varphi)g)^{\gamma} - c \tag{3.6}$$

We follow common practice by using the functional form of the utility function given in equation 3.7 with a constant elasticity of marginal utility.

$$u(c) = \frac{c^{1-\sigma} - 1}{1-\sigma} \tag{3.7}$$

Maximizing equation (3.4) subject to (3.6) yields the following.[21]

$$\frac{\dot{c}}{c} = \mu = \frac{(1-\tau)V\alpha k^{(\alpha-1)}\varphi^{\beta}(1-\varphi)^{\gamma} g^{(\beta+\gamma)} - \rho}{\sigma} \tag{3.8}$$

Equation (3.8) represents the rate of growth in consumption or the steady state growth rate.

[20] See Romer (1996)
[21] See Appendix A for details

The Impact of Governance (ψ) on the Rate of Growth (μ)

Recall that the composition of expenditures, φ, is a function of the quality of governance, ψ. That is:

$$\mu = f(V, \varphi) \text{ and } \varphi = \varphi(\psi) \tag{3.9}$$

$$\rightarrow \frac{d\mu}{d\psi} = \frac{d\mu}{dV} \times \frac{dV}{d\psi} + \frac{d\mu}{d\varphi} \times \frac{d\varphi}{d\psi} \tag{3.10}$$

In our framework, equation (3.10) represents the impact of governance on the rate of growth. The first term on the right-hand side is the growth effect of governance through efficiency enhancement and the second term indicates the growth effects of governance via the composition of public expenditures.

From equation (3.8),

$$\frac{d\mu}{dV} = \frac{(1-\tau)\alpha k^{(\alpha-1)} \varphi^{\beta} (1-\varphi)^{\gamma} g^{(\beta+\gamma)}}{\sigma} \tag{3.11}$$

$$\frac{dV}{d\psi} = A_{\psi}\psi + A \tag{3.12}$$

$$\frac{d\mu}{d\varphi} = \frac{(1-\tau)V\alpha k^{(\alpha-1)} g^{(\beta+\gamma)}}{\sigma} [(1-\varphi)^{\gamma} \beta\varphi^{(\beta-1)} - \varphi^{\beta}\gamma(1-\varphi)^{(\gamma-1)}] \tag{3.13}$$

$$\frac{d\varphi}{d\psi} = \varphi_{\psi} \tag{3.14}$$

Thus, $\frac{d\mu}{d\psi}$ is given by:

$$\frac{d\mu}{d\psi} = \frac{(1-\tau)\alpha k^{(\alpha-1)} \varphi^{\beta} (1-\varphi)^{\gamma} g^{(\beta+\gamma)}}{\sigma} \times (A_{\psi}\psi + A) + \frac{(1-\tau)V\alpha k^{(\alpha-1)} g^{(\beta+\gamma)}}{\sigma} [(1-\varphi)^{\gamma} \beta\varphi^{(\beta-1)} - \varphi^{\beta}\gamma(1-\varphi)^{(\gamma-1)}] \times \varphi_{\psi} \tag{3.15}$$

$$\rightarrow \frac{d\mu}{d\psi} = \frac{A}{\sigma}(1-\tau)\alpha k^{(\alpha-1)}\varphi^{\beta}(1-\varphi)^{\gamma} g^{(\beta+\gamma)}\left[(A_{\psi}\psi + A) + \psi A\left(\frac{\beta}{\varphi} - \frac{\gamma}{(1-\varphi)}\right)\varphi_{\psi}\right] \qquad (3.16)$$

Equation 3.16 represents the total effect of quality of governance on long run growth. The same equation also shows that the total effect is made up of the "direct effect" (i.e. the effect of governance on the rate of growth that is transmitted through channels other than the composition of public expenditures), and the "indirect effect," which is transmitted through the composition of public expenditures.

We also note that the sign of this total impact depends on the sign of the bracketed term. The first term in the brackets ($A_{\psi}\psi + A$) is positive. By assumption, the measure of quality of governance (ψ) is positive, and so is the level of technology (A). We also assume that the change in the level of technology with respect to changes in the quality of governance is positive (i.e. $A_{\psi} > 0$). This later assumption is based on the fact that better institutions (which include effective protection of property rights, copyright laws, and a low risk of expropriation of private property) may encourage innovations and transfer of technology through foreign direct investment.

The second term in the brackets has three components. The first one ($A\psi$) is positive based on the assumptions on A and ψ . The sign of the second component $\left(\frac{\beta}{\varphi} - \frac{\gamma}{(1-\varphi)}\right)$ is indeterminate. That is, $\left(\frac{\beta}{\varphi} - \frac{\gamma}{(1-\varphi)}\right)$>0 if $\frac{\beta}{\gamma} > \frac{\varphi}{(1-\varphi)}$. In other words, the ratio of relative elasticities (β, γ) is greater than the ratio of relative shares of g_1 and g_2 in total spending. This implies that the impact of a change in φ on the rate of growth depends not only on the productivity of g_1, but also on the initial shares of total

spending allocated to the two types of expenditures (Devaranjan, Swaroop, and Zou 1996).

The Link between Governance and the Composition of Public Expenditures

Our main interest is in the sign of the last component of the second term in the brackets (φ_{ψ}) in equation 3.16. This term measures the effect of quality of governance on the composition of public expenditures. We argue that the sign of this effect depends on the type of expenditures denoted by g_1 and g_2.

For simplicity, let's continue to assume that there are two types of expenditures – one type that is susceptible to rent extraction by the decision-maker (g_1), and the other that is less (or not) susceptible to rent extraction (g_2). The literature suggests that the first category might include spending on defense and public investment. This hypothesis follows from the fact that these expenditures – defense spending and public capital investment – tend to be more complex, less transparent, and thus not exposed to public scrutiny.

On the other hand, category two – expenditures less susceptible to rent extraction – might include education and health expenditures. These expenditures are more direct and often fixed for a relatively long period of time. For example, employee salaries, or classroom equipment are easier to verify compared to expenditures on big public investment projects such as energy plants , major highways, etc. The same is the case for military equipment.[22]

[22] See for example, Mauro (1998) , and Tanzi and Davoodi (1997)

However, good and or democratic institutions place a constraint on decision-makers as to the extent of rent extraction. In other words, the degree of venality depends on the quality of institutions. Elected officials operating in a democratic and transparent environment would allocate resources, to a bigger extent, to maximize social welfare as this increases the likelihood of re-election. On the other hand, in a less democratic and less transparent system, political power does not derive from competitive elections, and thus social welfare maximization is likely to be a secondary or tertiary objective of decision-makers. Maximizing rents will likely be the main objective.

Thus, if g_1 and g_2 are as defined above, and φ is the share of g_1 in total expenditures, then, from equation (3.16), $\varphi_\psi < 0$. With weak institutions, the opportunity cost of extracting rents (in terms of the likelihood of losing political power) is low. As such, public spending will likely be biased towards those expenditure types or functions that maximize rents rather than social welfare. On the other hand, if we define φ as the share of g_2 in total public spending, and g_2 is as described above, then we should expect $\varphi_\psi > 0$. This would imply that with better quality institutions (characterized, for instance, by democracy and transparency), the decision-making authority will seek to maximize social welfare. Thus public spending will be biased toward expenditure types and/or functions that maximize social welfare.

For a more formal illustration of the propositions in the preceding discussion, let's assume that the government (decision-maker) maximizes the following utility function[23].

$$V_{GOV} = \psi U^M + (1-\psi)R \qquad (3.17)$$

Subject to: $\tau y = g_1 + g_2 = g$

[23] This form of the government utility function is obtained from Panizza (1999).

Where U^M is the utility of the median voter or a representative consumer in the country, and R are the rents extracted by the decision-maker. For simplicity, we assume rents can only be extracted from expenditure type g_1, while the median voter derives utility from government expenditure type g_2.

A simple interpretation of the utility function in equation 3.17 is that with the lowest quality of governance $(\psi = 0)$, decision makers will not care about the utility of the median voter and will therefore allocate the entire public budget to g_1 in order to maximize rents. On the other hand, with the highest quality of governance $(\psi = 1)$, the decision maker allocates the entire public budget to g_2 in order to maximize social welfare. This is of course a highly simplified case since, in practice, some spending on g_1 could enter into the median voter's utility function, and some spending on g_2 might also be subject to rent extraction. However, we believe that although this simplification will likely affect the magnitude of the bias toward one expenditure type or the other, our main propositions about the direction of the bias in allocation of public expenditures between g_1 and g_2 should still hold.

The quality of governance (ψ) is assumed to lie between zero and one. Rents (R) are a certain proportion (θ) of g_1 [24].

That is:

$$R = \theta g_1 \tag{3.18}$$

$$U^M = g_2^a c^d \tag{3.19}$$

[24] For simplicity, we take θ as given (exogenous). However, in practice, this ratio of rents to expenditures might also be dependent on the quality of governance.

Where c is personal consumption, $0 \prec a, d \prec 1$, and $a + d = 1$

Substituting 3.18 and 3.19 into 3.17 yields,

$$V_{GOV} = \psi g_2^a c^d + (1-\psi)\theta g_1 \tag{3.20}$$

Maximizing 3.20 with respect to g_1 and g_2 subject to the balanced budget constraint given above (also in equation 3.2), we obtain the optimal values of g_1 and g_2 as follows.

$$g_1 = y\tau - \left(-\frac{\theta(\psi-1)}{a\psi c^d}\right)^{\frac{1}{(a-1)}} \tag{3.21}$$

$$g_2 = \left(-\frac{\theta(\psi-1)}{a\psi c^d}\right)^{\frac{1}{(a-1)}} \tag{3.22}$$

Our interest is the effect of quality of governance on g_1 and g_2. We therefore take derivatives of g_1 and g_2 (in equations 3.21 and 3.22 respectively) with respect to ψ.

$$\frac{dg_1}{d\psi} = -\left(-\frac{\theta(\psi-1)}{a\psi c^d}\right)^{\frac{1}{(a-1)}} \times \frac{1}{(a-1)(\psi-1)\psi} < 0 \tag{3.23}$$

$$\frac{dg_2}{d\psi} = \left(-\frac{\theta(\psi-1)}{a\psi c^d}\right)^{\frac{1}{(a-1)}} \times \frac{1}{(a-1)(\psi-1)\psi} > 0 \tag{3.24}$$

Equations 3.23 and 3.24 show the effect of quality of governance on the two expenditure functions or types. Equation 3.23 shows that expenditure on g_1 goes down with an improvement in the quality of governance, which implies that less weight is attached to maximizing rents and more to social welfare. Equation 3.24, on the other hand, shows the opposite of the relationship in equation 3.23.

Summary of the Theoretical Analysis

In summary, we have determined that the magnitude and size of the total effect of quality of governance on long run growth is theoretically indeterminate due to the several potential channels through which this effect is transmitted. In this simple model we examined one of the potential transmission channels – the composition of public expenditures. We show, theoretically, that some expenditure types are relatively more susceptible to rent extraction than others and are therefore likely to be favored by rent-seeking decision-makers in the absence of effective checks and balances.

Further, as suggested by Devaranjan et al. (1996), the effect of changes in the composition of expenditures on growth also depends on the initial composition. For example, Devaranjan et al.(1996) show that capital spending in developing countries has a negative impact on growth because these countries are already spending more than "optimal" on public investment. This finding agrees with the World Bank Public expenditure reviews in developing countries. This theoretical ambiguity surrounding the role of governance in development makes the case for an empirical analysis.

In Chapter IV we develop an empirical methodology to estimate the growth effect of governance (expressed in equation 3.16) and provide the empirical results in Chapter V. In addition to estimating the growth effects of governance, we estimate the effect of quality of governance on various public expenditure functional categories (i.e. φ_{ψ}) and on the share of capital expenditures in total public expenditures to investigate the potential indirect effects of governance through the composition of public expenditures.

CHAPTER IV

EMPIRICAL METHODOLOGY

In this Chapter, we develop an empirical methodology for analyzing various aspects of the direct and potential indirect growth effects of governance. First, we examine the total (direct plus indirect) growth effect of quality of governance. We will use a number of indicators of governance to estimate the effect of quality of governance on economic growth. Using several indicators of governance allows us to capture the growth effects of the different aspects or dimensions of governance. For example, we could have a democracy with high corruption or an inefficient bureaucracy. As previously indicated, we will do a sub-sample regression analysis for Sub-Saharan Africa due to its less developed status and the fact that it has had more political and institutional problems in the recent decades.

Further, we use a two-stage least squares (2SLS) approach in an attempt to separate the direct and indirect growth effects of governance. We include measures of expenditure composition among other control variables in the growth model in order to estimate the growth effects of governance channeled through mechanisms other than expenditure composition. We instrument for the various expenditure categories (education, health, and defense) using demographic variables.

The share of the population below 14 years of age is used to instrument for the share of education in total public expenditure. The share of total population between the

ages of 15 and 64 is used as an instrument for the share of defense spending in total public spending. It is argued that most rebellious activities against governments are done by middle-aged individuals, which may necessitate more defense spending. Lastly, the proportion of the total population 65 years and older is used as an instrument for the share of health spending in total spending.

In addition to the 2SLS, we use the system GMM estimator that uses "internal instruments" for the endogenous variables in the presence of a persistent dependent variable such of growth in per capita GDP and also because of lack of good instruments for endogenous explanatory variables.[25]

In the second section of the Chapter, we develop a methodology to analyze potential indirect effects of quality of governance through the composition of public expenditure. We estimate a set of seemingly unrelated equations with functional categories of public expenditure as dependent variables. The functional categories analyzed are public expenditure on health as a share of total expenditure, public expenditure on education as a share of total expenditure, and defense expenditure as a share of total expenditure. We also estimate the impact of governance on the share of capital expenditure to investigate any effects of quality of governance on the composition of expenditures by "economic type." This is a separate regression model and is not part of the seemingly unrelated system of equations because it's based on a different classification of public expenditures.[26]

[25] More on this is discussed later in the Chapter.
[26] Classification of public expenditures is also discussed later in the Chapter.

Income Growth Rate and Quality of Governance

The empirical growth model that we estimate in this dissertation follows the neoclassical growth model estimated by earlier researchers such as Barro (1991) and Mankiw, et al. (1992) with some extensions. Following more recent growth studies (Barro 1997; Gyimah-Brempong 2002), we include indicators of quality of governance as additional determinants of the rate of growth in real per capita income.

The neoclassical growth model, developed by Ramsey (1928), Solow (1959), and Swan (1965) emphasized the convergence property – the lower the starting level of real per capita income, the higher the growth rate in per capita output – and most empirical work that followed the development of these models tends to support it.

As Barro (1997) explains, "in the neoclassical model, the steady-state capital per worker and output depend on a number of environmental and choice factors such as propensity to save, population growth rate, etc." Due to cross-country variations in these factors, the convergence is conditional.

The new endogenous growth theories have incorporated technological progress and R&D into the growth model (Barro and Sala-i-Martin 1995; Romer 1990). These relatively new extensions highlight the role of government in the growth process. Actions of government regarding infrastructure development, regulation of international trade and other aspects of the private business sector, maintaining the rule of law, and the development of the financial markets can have significant effects on the growth process.

The model we estimate in this study is within the framework of these extensions to the neoclassical growth model. In addition to the "traditional" determinants of growth, we include indicators of institutional quality and political freedoms as determinants of variations in growth, and potential explanations for variation in per capita income growth rates across countries.

Based on this background, the growth equation that we estimate can be expressed as follows:

$$gdppcg_{it} = \beta_0 + \beta_1 igdppc_{it} + \beta_2 invest_{it} + \beta_3 \exp ort_{it} + \beta_4 school_{it} + \beta_5 govcon_{it} + \beta_6 gov_{it} + u_{it} \quad (4.1)$$

Where *gdppcg* is the annual growth rate in real per capita output; *igdppc* is the initial level of per capita *GDP*; *invest* is total domestic investment as a percentage of GDP; *school* is the average years of schooling for the population 15 years or older. *Export* is the rate of export growth; *govcon* is general government final consumption expenditure as a percentage of GDP, which includes all government current expenditure for purchases of goods and services (including compensation of employees). It also includes most expenditure on national defense and security and excludes government military expenditure; *gov* is an indicator of quality of governance or institutions; and u_{it} is the error term.

We expect a negative relationship between *igdppc* and the rate of growth in per capita output based on the convergence hypothesis described above. Based on the existing growth literature, we expect *export, invest,* and *school* to have a positive causal relationship with the rate of growth in per capita output, and *govcon* to have a negative impact on growth in per capita real output (Barro 1991, 1997; Levin and Renelt 1992).

We also expect lower quality of governance to have a negative impact on growth in per capita real output (Barro 1997).

More exports imply an expanding market for domestically produced goods and thus lead to higher employment and income per capita. Private investment increases the amount of physical capital per worker and overall production capacity. Further, investment in better technology leads to higher productivity and higher per capita income.

The variable *school* captures the level of education, which reflects the quality of the labor force. Better education makes it easier to adopt new technologies and to be innovative. Further, better education is associated with a more flexible workforce in terms of acquiring new skills as new sectors of the economy emerge. All this can be associated with higher productivity and, therefore, high growth rates in per capita GDP.

It is important to note that there are concerns about the right specification of the growth equation. In other words, what right-hand-side variables belong in the model? The literature on economic growth has identified a big number of variables that are believed to be partially correlated with growth. However, the question of the robustness of these correlations is an important one. Different researchers have employed different combinations of right-hand-side variables.

Sala-i-Martin (1997) conducts a robustness check study with 59 explanatory variables that had been found significant in other studies. He finds 22 of the 59 explanatory variables to be significant. A more recent study by Sala-i-Martin, et al. (2004) reaches a similar conclusion. In this recent study, Sala-i-Martin, et al. (2004) conclude that about "one-fifth of the 67 variables used in the analysis can be said to be

significantly related to growth, while several more are marginally related to growth." Some of the significant variables in Sala-i-Martin, et al. (2004) include investment price, fraction of tropical area, dummies for East Asia, Sub-Saharan Africa, and Latin America, primary schooling at the beginning period (1960), GDP per capita (1960), Spanish colony, fraction Muslim, number of years with an open economy, ethno-linguistic fractionalization, etc.

However, there should be concerns about the likely multicollinearity among right-hand-side variables. Due to these concerns, we do not include all the variables that have been found to be significantly related to growth in equation (4.1). For instance, La Porta, et al. (1999) finds that closeness to the equator; religious ideology, ethno-linguistic heterogeneity, and historical (or colonial) background have an impact on the quality of governance. Since we include an indicator of the quality of governance, we believe that inclusion of some of these geographic and demographic variables would lead to multicollinearity and biased standard errors of parameter estimates. We do however include some key variables suggested in Sala-i-Martin (1997) and Sala-i-Martin et al. (2004), although with some variations in the measurement of the variables.

Estimation Methodology

We choose a number of empirical estimation procedures, partly for the purpose of checking the robustness of the results to different econometric model specifications, and partly as an attempt to deal with some of the econometric issues such as endogeneity. First, we estimate Equation 4.1 using the Fixed Effects and the Random Effects

procedures. Second, we estimate the growth equation using the dynamic panel system GMM estimator.

Fixed effects and random effects[27]

The ordinary least squares (OLS) estimator is inefficient in the presence of unobserved individual specific effects and inconsistent if the individual effects are correlated with any of the regressors. Some panel data methods – *random effects* (RE) or *fixed effects* (FE) estimation procedures – are designed to remedy some of these shortcomings. Below, we provide a brief exposition of these two estimators.

Let

$$y_{it} = \beta_i x_{it} + c_i + u_{it} \qquad t = 1,2,...,T \tag{4.2}$$

Where y_{it} is the dependent variable, x_{it} is a vector of explanatory variables, c_i is the unobserved time-invariant country-specific effects, and u_{it} is a vector of idiosyncratic disturbances.

The *random effects* model assumes that the country-specific effects, c_i are uncorrelated with all explanatory variables, x_{it}, and combines the country-specific effects with the error term to form a composite disturbance term ($c_i + u_{it}$). However, the composite errors are serially correlated due to the existence of the time-invariant unobserved effects in the error term. The random effects procedure uses the generalized least squares (GLS) estimation procedure to deal with this serial correlation problem. If in

[27] This discussion is heavily based on Wooldridge (2002)

fact individual-specific effects are correlated with any of the explanatory variables, the random effects estimates are inconsistent.

The random effects estimator is given by:

$$\hat{\beta}_{RE} = \left(\sum_{i=1}^{N} X_i' \hat{\Omega}^{-1} X_i \right)^{-1} \left(\sum_{i=1}^{N} X_i' \hat{\Omega}^{-1} y_i \right) \tag{4.3}$$

The *fixed effects* model, on the other hand, assumes arbitrary correlation between the country-specific effects, c_i and the observed explanatory variables (x). The fixed effects estimation simply employs OLS estimation on a modified version of the basic model shown in (4.2) above. This fixed effects transformation is done by first averaging equation (4.2) over $t = 1,2,...,T$

That is, $\bar{y}_i = \bar{x}_i \beta + c_i + \bar{u}_i$ (4.4)

Where; $\bar{y}_i = T^{-1} \sum_{t=1}^{T} y_{it}$, $\bar{x}_i = T^{-1} \sum_{t=1}^{T} x_{it}$, and $\bar{u}_i = T^{-1} \sum_{t=1}^{T} u_{it}$

We subtract equation (4.4) from equation (4.2) to obtain the following fixed effects transformed equation.

$$y_{it} - \bar{y}_i = (x_{it} - \bar{x}_i)\beta + (u_{it} - \bar{u}_i) \tag{4.5}$$

This transformation "sweeps out" the individual (unobserved) specific effect. Equation (4.5) can then be estimated by OLS to obtain consistent estimates of the parameter vector, β . Equation (4.5) is simply an estimating equation. All inference is based on equation (4.2).

One drawback of the fixed effects estimator is that the fixed effects transformation also "sweeps out" any observable time-invariant explanatory variables.

For example, we cannot have regional dummy variables or measures of ethnic fractionalization among the explanatory variables.

We conduct the Hausman (1978) specification test to compare the appropriateness of the fixed effects model relative to the random effects model. The test is based on the difference between RE and FE estimates. Under the null hypothesis, unobserved individual effects are uncorrelated with observed explanatory variables. Both the random effects and the fixed effects are consistent but the random effect is efficient. This implies that a statistically significant difference between the two estimators is evidence against the nonexistence of correlation between the country-specific unobserved effects and the observed explanatory variables as assumed by the random effects model (Wooldridge 2002). This would support the fixed effects model against the random effects.

If $\hat{\beta}_{FE}$ is an $M \times 1$ vector of fixed effects estimates, and $\hat{\beta}_{RE}$ is an $M \times 1$ vector of random effects estimates, then the Hausman statistic, H, can be computed as follows. $H = (\hat{\beta}_{FE} - \hat{\beta}_{RE})'[A\hat{V}ar(\hat{\beta}_{FE}) - A\hat{V}ar(\hat{\beta}_{RE})]^{-1}(\hat{\beta}_{FE} - \hat{\beta}_{RE})$ and is asymptotically distributed as χ^2_M under the null hypothesis, where $A\text{var}(.)$ denotes the asymptotic variance.

The Hausman test conducted on a baseline specification of (4.1) generates a highly significant test statistic. We therefore reject the null hypothesis of no correlation between the country-specific unobserved effects and the observed explanatory variables. This result suggests using a fixed effects model. However, for completeness, we also estimate a random effects model.

Endogeneity

In terms of the growth equation outlined in equation (4.1), we suspect that the error process is correlated not only with the growth rate in income per capita, but also some right hand-side variables such as investment, export growth, and the quality of governance. Such unobserved factors might include interest rate shocks, unexpected political events such as military coups, etc.

The consistency of parameter estimates from the two estimators – random effects, and fixed effects – discussed above is based on the assumption that the error term is uncorrelated with any of the explanatory variables. However, the problem of endogenous explanatory variables in the growth equation is a well established finding in the growth literature. Nonetheless, for the sake of completeness, we employ the Hausman (1978) specification test to test for endogeneity in equation (4.1).

The Hausman test examines the difference between two estimators given by $D = \sqrt{NT}\,(\beta_{IV} - \beta_{LS})$.

Under the null hypothesis of no endogeneity, both estimates are consistent and $D = 0$. However, under the alternative hypothesis D ≠ 0.

The Hausman test statistic is distributed χ^2 and is computed as:

$$H = (\beta_c - \beta_e)'(V_c - V_e)^{-1}(\beta_c - \beta_e) \qquad (4.6)$$

Where β_c is the coefficient vector from the consistent estimator; β_e is the coefficient vector from the efficient estimator; V_c is the covariance matrix for the consistent estimator; and V_e is the covariance matrix for efficient estimator.

Table E5 (in the appendix) provides some results of the Hausman tests for endogeneity of investment, schooling, government consumption, the growth rate of exports, and an indicator of quality of governance (index of political freedom). The results confirm that investment as a percentage of GDP and the rate of growth in exports are endogenous in growth. However, tests statistics for schooling, general government consumption, and the quality of governance as measured by an index of political freedom are not statistically significant. The instruments used to construct the tests are the lagged values of the variables. For example, the lagged values of the variable *invest* are used to instrument for investment as a percentage of GDP.

It's important to note that the validity of the Hausman test results depends on the validity of instruments used in the test. Due to this caveat, we do not solely rely on the results of the Hausman tests in Table E5. To our knowledge, there are no typical instruments in the literature for most of the right-hand-side variables in equation (4.1). As such, we rely more on theory and anecdotal evidence provided in the literature to determine what right-hand-side variables in equation (4.1) might be endogenous. For example, random shocks such as unexpected military coups might affect private investment, quality of governance, government consumption, exports, and the rate of growth in per capita GDP. If this is the case, then all these right-hand-side variables might be correlated with the error term and thus endogenous. As mentioned above, failure to remedy this problem leads to inconsistent estimates of the parameters.

Although not much attention was paid to this issue in earlier growth studies, recent economic growth literature (Beck, Levine, and Loayza 2000; Bond, Hoeffler, and Temple 2003; Gyimah-Brempong 2002) has employed newly developed instrumental

variable techniques to deal with endogeneity problems in growth empirical studies. These estimation techniques are based on dynamic panel data methods developed by Anderson and Hsiao (1982) , Arellano and Bond (1991), and Blundell and Bond (1998). In this study, we follow the framework developed in these studies and others that have applied these techniques to growth equations to estimate equation (4.1). A brief description of these methods is provided below.

Dynamic panel GMM estimation[28]

Both the random effects and the fixed effects estimates are inconsistent in the presence of a persistent dependent variable and endogenous regressors. As noted earlier, based on the Hausman test, theory, and anecdotal evidence in the literature, right-hand-side variables in equation (4.1) are correlated with the random error term. This leads to inconsistent fixed and random effects estimates. For this reason, in addition to the fixed and random effects estimators, we conduct an instrumental variable estimation developed by Anderson and Hsiao (1982), Arellano and Bond (1991), and Blundell and Bond (1998), which allows us to obtain consistent estimates of the growth equation in the presence of dynamics and endogenous explanatory variables. Following is a brief description of the basic approach[29].

The approach involves writing equation (4.1) as a dynamic panel data model, and first difference the dynamic equation to get rid of the individual specific effects. We then

[28] This section draws heavily on the work of Arellano and Bond (1991); Baum et al. (2003); Bond et al. (2003); Loayza et al. (2000); and Rioja and Valev (2004).
[29] See details in Appendix B

instrument the differenced right-hand-side variables with appropriately lagged levels (Bond, Hoeffler, and Temple 2003). Let the growth equation take the following form:

$$y_{it} = \alpha y_{i,t-1} + x'_{it}\beta + c_i + v_{it} \quad \text{for } i = 1,...N \text{ and } t = 2,...T \tag{4.7}$$

Where y_{it} represents the rate of growth in real per capita GDP; x_{it} represents variables that potentially affects the rate of growth; and c_i is a set of unobserved, time-invariant, country specific effects. We first-difference equation (4.7) to eliminate the country specific effect, c_i. Thus:

$$y_{it} - y_{i,t-1} = \alpha(y_{i,t-1} - y_{i,t-2}) + (x_{it} - x_{i,t-1})'\beta + (v_{it} - v_{i,t-1}) \tag{4.8}$$

By construction, the differenced lag of the growth rate $(y_{i,t-1} - y_{i,t-2})$ in equation (4.8) is endogenous. Further, as noted earlier, X contains endogenous variables. Therefore, we need instruments to consistently estimate equation (4.8). On the assumption that the error terms in (4.7) are serially uncorrelated, i.e. $E(v_{it}v_{is}) = 0$, the following moment conditions yield appropriate instruments for the differenced lagged dependent variable and endogenous explanatory variables.

$$E[y_{i,t-s}\Delta v_{it}] = 0 \text{ for } t = 3,...,T \text{ and } s \geq 2 \tag{4.9}$$

$$E[x_{i,t-s}\Delta v_{it}] = 0 \text{ for } t = 3,...,T \text{ and } s \geq 2 \tag{4.10}$$

The moment conditions in equations (4.9) and (4.10) allow us to use suitably lagged levels as instruments for the first differenced endogenous variables. However, when lagged levels of the series are weakly correlated with subsequent first-differences, the Arellano and Bond (1991) differenced GMM estimator has been found to have a small sample bias problem (Blundell and Bond 1998).

To deal with the potential bias in the differenced GMM estimates, Arellano and Bover (1995) and Blundell and Bond (1998) proposed an estimator that makes use of additional information in levels. This relatively new estimator is referred to as the system GMM estimator. This approach combines two sets of equations - one set in first-differences and another in levels – into a system of equations. This introduces additional $T-2$ linear moment restrictions given by:

$$E[(c_i + v_{it})\Delta y_{i,t-1}] = 0 \tag{4.11}$$

$$E[(c_i + v_{it})\Delta x_{i,t-1}] = 0 \tag{4.12}$$

The system GMM estimator uses the moment conditions in equations 4.9, 4.10, 4.11, and 4.12 to consistently estimate the parameters of interest in equation (4.7).
It should be noted that valid instruments should be correlated with the included endogenous explanatory variable and, at the same time, orthogonal to the error term. To ensure the validity of the instruments, we conduct the Hansen (1982) test for over-identifying restrictions to jointly test the appropriateness of the instruments. The null hypothesis for the test is that the instruments are valid in that they are uncorrelated with the errors. Under the null, the test statistic has a $\chi^2_{(L-k)}$ distribution, where L is the number of instruments and k is number of parameters in the model[30].

Further, as noted earlier, the consistency of the GMM estimator depends on the assumption of white noise errors in the levels equation. If in fact the errors are serially correlated, the GMM estimator will lose its consistency. We thus test for second-order autocorrelation in the differenced equation. The test statistic developed by Arellano and

[30] See Appendix B for details.

Bond (1991) is given in appendix B. By construction, we should expect the presence of first-order serial correlation in the first-differenced equation.

The "direct" versus "indirect" growth effects of governance

As earlier mentioned, we do a 2SLS estimation in an attempt to separate the growth effects of governance that are transmitted through channels other than expenditure composition (referred to in this dissertation as the direct effect) and the indirect effects of governance that are channeled through the composition of public expenditures. These "direct" channels could include changes in productivity resulting from changes in the quality of governance. It is argued that good governance encourages citizen participation in the development efforts of a country, which in turn increases productivity.

First, we estimate the direct effect of quality of governance (gov) on economic growth by controlling for the indirect effect (through the composition of public expenditures.

That is,

$$gdppcg_{it} = \beta_0 + \beta_1 gov_{it} + \beta_j \sum_{j=2}^{4} Expcomp_{itj} + \beta_5 X_{it} + \varepsilon_{it} \qquad (4.13)$$

Where *gdppcg* is the growth rate in real per capita GDP; *gov* is a measure of quality of governance (we use an index of freedom for this); *Expcomp* is the share of each expenditure component (education, health, and defense), and *X* is a vector of other control variables in the growth equation.

To tease out the indirect effect, we need "first-stage" estimates. We instrument for the share of education expenditure using the proportion of the total population below 14 years of age. We use the proportion of the total population 65 years and older and the fertility rate as instruments for the share of health expenditure in total public spending; and the proportion of the total population between the ages of 15 and 64 to instrument for the share of defense spending in total public expenditures.

Thus, the three first-stage equations take the following form.

$$\begin{aligned} Educ_{it} &= \alpha_0 + \alpha_1 gov_{it} + \alpha_2 X_{itj} + \zeta_{it} \\ Health_{it} &= \delta_0 + \delta_1 gov_{it} + \delta_2 X_{itj} + \nu_{it} \\ Defense_{it} &= \sigma_0 + \sigma_1 gov_{it} + \sigma_2 X_{itj} + \omega_{it} \end{aligned} \tag{4.14}$$

Where X_{itj} includes identifying instrument(s) for expenditure share j (j ≡ education expenditure share, health expenditure share, defense expenditure share)

To obtain the total effect (direct plus indirect), we substitute for *Expcomp* in equation (4.13) using equations (4.14) and take the derivative of *gdppcg* with respect to *gov* to obtain the following.

$$\frac{\partial(gdppcg)}{\partial(gov)} = \beta_1 + (\beta_2 \times \alpha_1 + \beta_3 \times \delta_1 + \beta_4 \times \sigma_1) \tag{4.15}$$

In this framework, the first term on the right-hand-side of equation (4.15), β_1, is the growth effect of governance that is transmitted through channels different from the composition of expenditures (direct effect). On the other hand, the indirect effect of governance that is channeled through the composition of expenditures if represented by the term in parenthesis in equation (4.15).

Quality of Governance and the Composition of Public Expenditure.

In this section of the Chapter, we explore the potential effects of quality of governance on allocation of public expenditure. This analysis is important for two main reasons. One, a number of studies have shown a direct relationship between the composition of public expenditure and economic growth (Bose, Haque, and Osborn 2003; Devaranjan, Swaroop, and Zou 1996; Sylwester 2000). All these studies treat the composition of expenditure as exogenous. Our goal in this section is to look at some of the determinants of the composition of public expenditure with particular interest in the quality of governance. Establishing this link between governance and the composition of public expenditure suggests potential indirect growth effects of governance via the composition of public expenditure.

The second main reason for this analysis relates to policymaking. Many developing countries, under the direction of international financial agencies (notably the World Bank and the International Monetary Fund), have embarked on comprehensive public sector reforms. Among the many reforms, there has been an effort to transform institutions of government, and re-examination of budgetary processes through public expenditure reviews. If a link between the quality of institutions and the composition of public expenditure is established, then resources could be better utilized by focusing on institutional reforms that would in turn lead to a more appropriate allocation of public spending given a country's social, economic, and political situation.

We look at both the functional composition of public expenditure and the composition by economic characteristics of the expenditure (capital versus recurrent).

Under the functional composition, we examine three components of expenditure – public expenditure on health, public expenditure on education, and defense expenditures. We choose these three spending categories mainly due to data availability.

Under economic classification of expenditure, we examine the determinants of capital expenditure with particular interest on indicators of quality of governance. All spending components are expressed as shares of total government expenditure. Below are the testable hypotheses that derive from the discussion in the theoretical Chapter.

The hypotheses

1. Countries that have lower quality of governance or have less political freedom are expected to spend relatively more on defense. This is because dictatorships that perpetuate repressive regimes (with lower political freedom) have to rely on a relatively strong military to stay in power. A strong military comes at the expense of services to ordinary citizens such as education and health. This is partly because citizens do not determine the leadership of the country, and thus cannot express their preferences through a free and fair vote. Of course this hypothesis assumes away the rare cases of benevolent dictators. Most dictatorships are challenged, and this provides incentives to the dictatorship to have a strong army to guard against any potential threats to their power. We think that benevolent dictatorships will only exist where there are no immediate threats to the dictator's power.
2. Poor quality institutions and the lack of political rights and civil liberties lead to relatively lower public spending on health and education.

3. Further, weak and underdeveloped institutions will likely lead to relatively more capital spending and vice versa. For example, spending on big capital projects enhances opportunities for rent-extraction in form of hefty bribes and other forms of corruption.

Empirical Model and Estimation Methodology

Most research on the determinants of public expenditure has focused mainly on total expenditure (Dudley and Montmarquette 1992; Fan and Rao 2003; Preston and Ridge 1995; Singh and Sahni 1984) and on individual components of expenditure (Fan and Rao 2003; Snyder and Yackovlev 2000; Sturm 2001). However, some studies have empirically examined the functional composition of government spending using systems of equations (Sanz and Velázquez 2002; Yildirim and Sezgin 2002), and single equation models (Arze Del Granado, Martinez-Vazquez, and McNab 2005).

In this dissertation we follow Sanz and Valazquez (2002); and Yildirim and Sezgin (2002) to examine the determinants of the functional composition of expenditure. Both papers use the Zellner (1962) seemingly unrelated regressions (SUR) approach to estimate the determinants of the various categories of public expenditure. In addition, following Sturm (2001), we employ panel data methods to explore the determinants of public capital expenditure.

Our work improves on the empirics of these previous studies by taking into account the fractional nature of expenditure shares. We do this by employing nonlinear estimation methods designed for estimations involving fractional response variables (Papke and Wooldridge 1996).

In addition to improvements in estimation procedures, we explicitly control for institutional factors. As noted in the literature review, previous studies such as Sanz and Valazquez (2002) use country dummies to control for differences in institutional quality. Sturm (2001) uses such variables as the number of political assassinations and military coups to control for political factors. We think that these measures do not effectively capture the quality of governance since most countries experience very few coups or political assassinations if any at all. The result of this is that we will observe zero coups or political assassinations for most countries, which does not necessarily mean good governance or presence of political freedom and civil liberties. Further, following Mauro (1998), we examine both the *functional* composition of expenditures and composition by *economic type* (capital versus current expenditures).

The seemingly unrelated regressions (SUR) approach

Budgetary decisions to allocate spending to various spending categories are made simultaneously. That is, when deciding how much to allocate to a particular category, voters or the budgetary authority has to take into account their preferences regarding the other categories (Sanz and Velázquez 2002). Besides, there could be random shocks that affect all categories of spending contemporaneously. The SUR approach allows an efficient estimation of a system of equations with contemporaneous cross-equation error correlation. This approach, introduced by Zellner (1962), was extended to error components models by Avery (1977) and Baltagi (1995)[31].

[31] A description of the model set up is given in Appendix C

Fractional response variables[32]

As mentioned earlier, the dependent variables in the SUR model are proportions of total public expenditure allotted to various expenditure functions (health, education and defense). This implies that $0 \leq y_j \leq 1$ for $j = 1,...,3$. The fractional dependent variable makes linear estimation procedures inappropriate for a couple of reasons. First, as Papke and Wooldridge (1996) explain, "with a bounded dependent variable, the effect of any explanatory variable, x, on the dependent variable cannot be constant over the entire range of x unless the range of x is very limited." Second, the predicted values of y are not guaranteed to be between zero and one.

The most common way to deal with these problems is to perform a logistic (or log-odds ratio) transformation. If we assume that the model that describes y is given by: $y = \frac{1}{1+\exp(-X\beta)}$, then a log-odds ratio transformation yields the following result[33]

$$E\left(\ln[y/(1-y)/X]\right) = X\beta \qquad (4.17)$$

The dependent variable in equation (4.17) mapped to the real line and can be estimated using linear methods such as OLS.

However, this transformation poses a number of complications. First, extreme values of 0 and 1 would have to be adjusted before the transformation, otherwise one ends up with missing observations for these values because equation (4.17) is not defined for these extreme values. Further, it is difficult or even impossible to make a logical interpretation of the parameter estimates from the linear regression in (4.17). It is difficult to recover $E(y/x)$, which is the main interest in the analysis. With simple algebraic

[32] This sub-section is based on work by Papke and Wooldridge (1996) and Pindyck and Rubinfeld (1990).
[33] See Appendix D

manipulations, we are able to obtain an expression for change in y resulting from small changes in any of the explanatory variables as follows.[34]

$$\frac{\Delta y}{\Delta x} = \hat{\beta}[y(1-y)] \tag{4.18}$$

Where y is the dependent variable and $\hat{\beta}$ are parameter estimates from equation (4.17). To compute the partial effects from equation 4.18, we use the mean values of y are the mean values of the dependent variables. However, we should note that the expression in equation (4.18) is very limiting as it evaluates the partial effects only at the selected values of the dependent variables.

To circumvent the problems with the log-odds transformation approach, Papke and Wooldridge (1996) suggest an estimation procedure that models $E(y/x)$ directly as a logistic function given by:

$$E(y/X) = G(X\beta) = \frac{\exp(X\beta)}{[1+\exp(X\beta)]} \tag{4.19}$$

Where $G(\bullet)$ is a function such that $0 < G < 1$ for all real numbers. This ensures that the predicted values of the dependent variable lie within the expected interval of [0, 1]. The approach to estimate β as suggested by Papke and Wooldridge (1996) is the quasi-maximum likelihood estimation in a generalized linear models (GLM) framework, where the quasi likelihood function is the binary choice log likelihood given below.[35]

$$l(\beta) \equiv y\ln[G(X\beta)] + (1-y)\ln[1-G(X\beta)] \tag{4.20}$$

And $G(\bullet)$ is the logistic function in equation (4.15). The QML estimator of β is given by:

$$\max_{\beta} \sum_{i=1}^{N} l_i(\beta), \tag{4.21}$$

The marginal effect of any given explanatory variable x on the dependent variable y is derived from equation (4.19) as follows:

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[34] See Appendix D and Pindyck and Rubinfeld (1990)
[35] Also see Wooldridge (2002); pp 661-663.

$$\frac{\partial E(y/X)}{\partial x} = \frac{\partial G(X\beta)}{\partial (X\beta)} \times \hat{\beta} \tag{4.22}$$

Where $\frac{\partial G(X\beta)}{\partial (X\beta)} = \frac{\exp(X\beta)}{[1+\exp(X\beta)]^2}$ and $\hat{\beta}$ is a vector of quasi-maximum likelihood estimates obtained from equation (4.21).

The empirical model

In this sub-section, we describe the specific empirical model used to analyze the effect of quality of governance and/or institutions on the functional and economic (capital versus current expenditure) composition of expenditure.

For the functional composition, we estimate the following set of three equations.

$$HEALTH_{it1} = \beta_{01} + \beta_{11} GOV_{it} + \beta_{21} X_1 + u_{it1}$$

$$EDUC_{it2} = \beta_{02} + \beta_{12} GOV_{it} + \beta_{22} X_2 + u_{it2} \tag{4.23}$$

$$DEFENSE_{it3} = \beta_{03} + \beta_{13} GOV_{it} + \beta_{23} X_3 + u_{it3}$$

In all the equations, "*GOV*" is an indicator of governance or quality of institutions. The matrix, X_1, consists of control variables for the health expenditure equation. Such variables include per capita GDP, the government budget balance, population growth and age structure, the rate of urbanization, and time dummies.

Sanz and Velázquez (2002) reports that higher per capita income has been associated with increased spending in most expenditure functions. However, the effect of per capita income on shares of different expenditures in total spending is not immediately obvious. It is possible that higher per capita income leads to more spending on health relative to defense.

We also control for population growth since we expect that a rapidly growing population will necessitate increased spending on health care. So we expect a positive correlation between population growth and the share of health spending. We also include population age structure. An older population is expected to increase demand for health care. Therefore the percentage of total population that is over 65 years is expected to be associated with relatively more public spending on health (Blomqvist and Carter 1997; Sanz and Velázquez 2002).

The budget balance is included to capture the effect of macroeconomic instabilities on health spending relative to other expenditure functions. We make no priors regarding the expected effect of the budget balance on health share of spending.

The matrix, $X_{2,}$ contains control variables in the education expenditure equation, and consists of GDP per capital, the government's budget balance, population growth rate and age structure, and time dummies. Most of these variables are similar to control variables in the health expenditure equation, and they are used to control for similar effects. However, the age structure variable is different. We believe that the age group that will likely impact education expenditures is the younger group. Therefore, we expect the share of education in total spending to be positively associated with the percentage of the population in the school-going age group.

The matrix, $X_{3,}$ consists of control variables in the defense spending equation, and consists of per capita GDP, the government's budget balance, the rate of urbanization, population growth rate and age structure, and population density. For the population age structure in the defense spending equation, we include the percentage of the total population between the ages of 18 and 64 years. As mentioned earlier, it is suggested in

the literature that most illegal actions are committed by individuals or groups of individuals between the ages of 18 and 25. So, we expect a positive partial correlation between the percentage of young adults in the total population and defense spending (Sanz and Velázquez 2002).

To estimate the equations in (4.23), we first perform a logistic transformation on each of the three dependent variables and then estimate the system using the Zellner (1962) seemingly unrelated approach. That is, using equation (4.17) the system of equations in (4.23) becomes:

$$\ln[HEALTH_{i,t1}/(1-HEALTH_{i,t1})] = \beta_{01} + \beta_{11}GOV_{i,t} + \beta_{21}X_1 + u_{i,t1}$$

$$\ln[EDUC_{i,t2}/(1-EDUC_{i,t2})] = \beta_{02} + \beta_{12}GOV_{i,t} + \beta_{22}X_2 + u_{i,t2} \quad (4.24)$$

$$\ln[DEFENSE_{i,t3}/(1-DEFECNSE_{i,t3})] = \beta_{03} + \beta_{13}GOV_{i,t} + \beta_{23}X_3 + u_{i,t3}$$

We also estimate individual equations in (4.23) using the QML methods suggested by Papke and Wooldridge (1996). That is

$$HEALTH_{i,t1} = G(\beta_{01} + \beta_{11}GOV_{i,t} + \beta_{21}X_1 + u_{i,t1}) \quad (4.25)$$

$$EDUC_{i,t2} = G(\beta_{02} + \beta_{12}GOV_{i,t} + \beta_{22}X_2 + u_{i,t2}) \quad (4.26)$$

$$DEFENSE_{i,t3} = G(\beta_{03} + \beta_{13}GOV_{i,t} + \beta_{23}X_3 + u_{i,t3}) \quad (4.27)$$

We analyze the effects of quality of governance and or institutions on capital expenditure using the two methods described above – the log-odds transformation approach and the quasi-maximum likelihood methods.

The equation we estimate is given below.

$$CAPITAL_{it} = \alpha_0 + \alpha_1 GOV_{it} + \alpha_2 X_4 + u_{it} \quad (4.28)$$

Where CAPITAL is public capital expenditure as a share of total government expenditure and X_4 is a matrix of control variables such as per capita GDP, growth in private investment, the government budget balance, population density, population growth, regional dummies, and time dummies.

Note that the capital expenditure model is separate from the SUR model used for the other public expenditure components – health, education, and defense. The reason for this is that capital spending is based on a different classification (classification by economic type) as described in the next section of this Chapter.

Data Description and Sources

Our empirical estimation employs an unbalanced panel data set of 90-100 countries[36] covering the period 1971– 2000. Details on data categories and sources are provided in the following sub-sections.[37]

Public Expenditure Data

Data on public expenditure by function and economic type are obtained from the IMF Government Finance Statistics (GFS). The IMF functional categories include general government services, public order and safety, defense, education, health, social security & welfare, housing & communication amenities, recreation, cultural & religious affairs, fuel and energy, transportation, etc. Due to lack of sufficient data, we use only three of the functional categories – education, health and defense expenditures.

Classification by economic type of the expenditure consists of current expenditure (expenditure on goods and services, wages and salaries, etc…) and capital expenditure (acquisition of fixed capital assets, land and intangible assets).

Governance Data

Governance data used in this paper are from two different sources. The first source of governance data is the "Freedom in the World Country Scores" compiled by Freedom House. The data includes scores for political rights and civil liberties. The two scores are

[36] The number of countries is smaller in the PRS (ICRG) data set.
[37] See also Appendix E for a summary of data description and sources.

measured on a one-to-seven scale, with one representing the highest degree of freedom and seven the lowest degree of freedom.

Political rights enable people to participate freely in the political process, which includes the right to vote and compete for public office and to elect representatives who have a decisive vote on public policies. Civil liberties include the freedom to develop opinions, institutions and personal autonomy without interference from the state.[38] Information used in the compilation of the scores is gathered from a broad range of sources including news reports, nongovernmental organizations' publications, think tank and academic analyses, etc.

The second source of governance data is the International Country Risk Guide (ICRG) compiled by the Political Risk Services (PRS) group. The PRS group is a commercial service that provides financial, economic and political risk assessment for investors. The data used in this paper are from the academic version of the ICRG.[39] The data consists of indicators of the risk of repudiation of contracts by government, risk of expropriation of private investment, corruption in government, rule of law, quality of bureaucracy, and ethnic tensions. Data are for the period 1982-1997 covering about 90 developed and developing countries.

The risk of contract repudiation and the risk of expropriation of private property are used in this analysis as proxies for contract enforcement, and protection of property rights respectively. We postulate that poor contract enforcement is an indication of institutional instability. The extent of government corruption and the index of the rule of

[38] See http://www.freedomhouse.org/reseach/freeworld/2003/methodology.htm for details and methodology. The data were also obtained from this Freedom House website.
[39] Source: Mina (2002).

law capture the extent to which citizens respect the rules that govern social and economic interaction. The quality of the bureaucracy captures institutional efficiency.

The risk of contract repudiation and the risk of expropriation are measured on a scale of 0-10, with a higher score indicating a lower risk. Government corruption, rule of law and the quality of the bureaucracy are measured on a scale of 0-6, with a higher score indicating better performance.

Other Explanatory Variables

Other economic and demographic variables used as control variables are obtained from the 2003 World Development Indicators CD-ROM. These variables include real GDP per capita, real GDP per capita growth rate, domestic investment, government consumption, and supplemental data on public expenditure such as health, and education. Also included here is data on government capital expenditure as a percentage of total government spending to supplement the GFS data. Data on schooling are obtained from the Barro and Lee (2000) dataset on education attainment across countries.[40]

[40] Data were obtained from http://www.cid.havard.edu/ciddata/ciddata.html.

CHAPTER V

EMPIRICAL RESULTS

In this Chapter, we report results of the empirical analysis conducted to investigate the direct and indirect growth effects of governance. The first section of the Chapter will discuss the empirical findings regarding the direct effect of quality of governance on growth. Under this section, we also report and discuss the empirical results for the Sub-Saharan Africa sub-sample. In the second part of the Chapter, we report and discuss empirical findings regarding the effects of quality of governance on allocation of public expenditure.

Quality of Governance and Growth in per Capita GDP

Although we report results from three estimation procedures[41], the detailed discussion of the results is based on the system GMM estimates. This is because we believe that the system GMM estimator effectively deals with the endogeneity problem, and thus gives consistent estimates. A brief discussion of the random and fixed effects estimates will me made as a way of comparing the results from the three estimators.

[41] We report System GMM, fixed effects and random effects results.

The System GMM (Dynamic Panel Model) Estimates

As pointed out in the preceding Chapter, in the presence of a persistent dependent variable and endogenous regressors, both the random effects and the fixed effects estimators are inconsistent. We therefore use a GMM dynamic panel data model to deal with this problem.

In Table 1, we present results obtained from a two-step system GMM dynamic panel estimator developed in Arellano and Bond (1991) and extended by Arellano and Bover (1995) and Blundell and Bond (1998). All the indicators of quality of governance have the expected sign and five of the six indicators are statistically significant. The indicator of political freedoms (labeled 'freedom') has a negative coefficient, but is statistically insignificant. This indicator is measured on a scale of 1 through 7 and a higher value of the index indicates lower political freedom. Therefore, a negative coefficient implies a negative impact of lower political freedoms on growth.

The rule of law index has the expected positive sign, implying that better maintenance of the rule of law is growth-enhancing. Specifically, a one standard deviation increase in the index of rule of law is associated with a 0.79 (1.63 x 0.485) percentage point increase in the rate of growth in real per capita GDP, all else constant.

The index of corruption also has the expected positive sign. A one standard deviation increase in the index of corruption is associated with a 0.91 (1.48 x 0.617) percentage point increase in the rate of growth in per capita GDP, all else constant.

An indicator of the quality of the bureaucracy shows a positive and statistically significant coefficient, implying that a better quality bureaucracy is good for growth. Specifically, a one standard deviation increase in the index of bureaucratic quality is

associated with a 0.34 (1.62 x 0.211) percentage point increase in the rate of growth in GDP per capita, all else equal.

Table 1. Dynamic Panel Estimates. The Dependent Variable is the Growth rate in Real per Capita GDP.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Initial GDP	-0.819 (0.508)	-0.348 (0.165)*	-0.442 (0.182)*	0.007 (0.231)	-1.137 (0.203)**	-0.524 (0.201)**
Govt. cons	-0.010 (0.037)	-0.054 (0.019)**	-0.058 (0.019)**	-0.031 (0.021)	-0.007 (0.017)	-0.032 (0.016)*
Investment	0.124 (0.041)**	0.233 (0.015)**	0.256 (0.016)**	0.241 (0.014)**	0.192 (0.014)**	0.224 (0.014)**
Export growth	0.199 (0.033)**	0.137 (0.010)**	0.127 (0.008)**	0.138 (0.010)**	0.151 (0.010)**	0.131 (0.010)**
Schooling	0.671 (0.263)*	0.121 (0.093)	0.191 (0.110)+	0.036 (0.127)	0.254 (0.125)*	0.180 (0.134)
Freedom	-0.228 (0.197)					
Rule of law		0.485 (0.098)**				
Corruption			0.617 (0.135)**			
Exprop. Risk						0.546 (0.087)**
Repud. Risk					0.951 (0.107)**	
Bureau Qual.				0.211 (0.126)+		
Observations	**540**	**345**	**345**	**345**	**345**	**345**
Countries	**100**	**90**	**90**	**90**	**90**	**90**
Hansen Test	**0.656**	**0.277**	**0.297**	**0.249**	**0.286**	**0.180**
AR(1)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
AR(2)	**0.484**	**0.636**	**0.305**	**0.449**	**0.582**	**0.402**

Standard errors are in parentheses. The reported results of the Hansen test, AR(1), and AR(2) are P-values.

+ Significant at 10%; * Significant at 5%; ** significant at 1%

The indexes of risk of repudiation of government contracts and the risk of expropriation of private property both have statistically significant effects on growth in real per capita GDP. A one standard deviation increase in the index of repudiation of contracts (lower risk) is associated with a 2.1 (2.18 x 0.951) percentage points increase in the rate of growth in real per capita GDP, all else constant. Likewise, a one standard deviation increase in the index of risk of expropriation of private property (lower risk) is associated with a 1.2 (2.2 x 0.546) percentage points increase in the rate of growth in real per capita GDP, all else constant.

In addition to proxies of governance, we include a number of control variables. The control variables included are those that have been found to significantly impact growth by previous researchers. We include initial GDP per capita based on the convergence hypothesis. Countries with a lower initial per capita GDP relative to the target (steady-state) level of per capita GDP will tend to grow faster and vice versa. This tendency is attributed to diminishing marginal productivity of capital.

The data used to estimate the growth equation are averaged over five-year periods from 1971 through 2000 to avoid modeling short-term cyclical fluctuations. Thus, the 30-year long panel reduces to a 6-period long panel. From this shorter panel we construct a variable (which we call Initial GDP per Capita) by taking the GDP per capita for the first year in every 5-year average. For example, for any country, j, the "Initial GDP per capita" corresponding to the 1971-1975 average is country j's GDP per capita for 1971.

For most of the specifications reported in Table 1, "Initial GDP per Capita" has a negative and statistically significant coefficient, which supports the convergence

hypothesis. That is, the higher the starting GDP per Capita, the lower the growth rate in real per capita GDP. This result repeats findings of most studies in the growth literature.

To evaluate the convergence hypothesis, we control for differences in the target levels of GDP per capita across countries. The controls included in the model are private investment ratio, government final consumption ratio, export growth, and education attainment.

Private investment is measured as a percentage of GDP. Our results show a positive and significant impact of private investment on growth in per capita GDP. The ratio of investment to GDP increases the target (steady-state) level of output per effective worker, and thus for a given starting level of per capita GDP, the growth rate will be higher (Barro 1997). For the different specifications reported in Table 1, a one standard deviation increase in the investment ratio is expected to increase the growth rate by 0.85 (0.124x6.86) to 1.76 (0.256x6.86) percentage points.

Government final consumption is also expressed as a percentage of GDP. Government final consumption enters the regression as a measure of government's nonproductive spending, but also controls for government size. We get a negative coefficient and statistically significant in three of the six specifications in Table 1. These results suggest that a smaller government is good for growth, all else constant. A one standard deviation increase in the government final consumption ratio is associated with a decline in the rate of growth in per capita GDP of about 0.19 (-0.032x5.86) to 0.34 (-0.058x5.86).

We include the growth rate of exports as a measure of openness. The coefficient on the growth of exports has the expected positive sign. It is statistically significant and

robust to specification changes. Table 1 shows that a one standard deviation increase in the growth rate of exports is associated with a 0.97 (0.131x7.41) to 1.47 (0.199x7.41) increase in real per capita GDP growth rate, all other things constant.

It is important to note that various studies have used trade (sum of exports and imports) as a percentage of GDP as a measure of openness. However, following Gyimah-Brempong (2002), we use the growth rate of exports. We think that developing countries that export a few low-priced primary products and import high-priced finished products may grow slower than countries importing raw materials and exporting finished products even though the total volume of trade may be the same. In short, we think that the composition of trade may matter for growth in some cases. Barro (1997) controls for the degree of openness using changes in terms of trade, defined as a ratio of export to import prices, and reports a positive and statistically significant effect on growth in per capita GDP.

Lastly, we control for differences in the quality of human capital using the average years of school for the population 15 years or older. As expected, Table 1 reports a positive coefficient on the schooling variable and is significant in half of the specifications reported. More and better quality human capital increases the steady-state output per effective worker and therefore increase growth rates in per capita GDP for a given starting value of output per effective worker. Specifically, a one standard deviation increase in the average years of schooling is associated with a 0.53 (0.191x2.8) to 1.88 (0.671x2.8) percentage points increase in real per capita GDP growth.

As mentioned above, we run the same specifications in Table 1 using the random effects and the fixed effects estimators. Table 2 reports the fixed effects estimates while Table 3 reports the random effects estimates.

Table 2. Fixed Effects Estimates. The Dependent Variable is Growth rate in Real per Capita GDP.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Initial GDP	-0.291 (0.051)**	-0.449 (0.079)**	-0.436 (0.08)**	-0.426 (0.08)**	-0.473 (0.076)**	-0.405 (0.079)**
Govt. cons	-0.071 (0.035)*	-0.012 (0.046)	-0.024 (0.047)	-0.025 (0.047)	-0.017 (0.044)	-0.008 (0.046)
Investment	0.158 (0.022)**	0.210 (0.034)**	0.221 (0.034)**	0.223 (0.034)**	0.194 (0.033)**	0.199 (0.034)**
Export growth	0.107 (0.015)**	0.109 (0.020)**	0.108 (0.020)**	0.108 (0.020)**	0.114 (0.019)**	0.110 (0.020)**
Schooling	0.357 (0.233)	0.588 (0.390)	0.705 (0.391)+	0.689 (0.387)+	0.162 (0.381)	0.325 (0.401)
Freedom	0.062 (0.121)					
Rule of Law		0.316 (0.191)+				
Corruption			-0.086 (0.210)			
Exprop. Risk						0.353 (0.124)**
Repud. Risk					0.659 (0.127)**	
Bureau Qual.				-0.165 (0.260)		
Observations	**540**	**345**	**345**	**345**	**345**	**345**
Countries	**100**	**90**	**90**	**90**	**90**	**90**
R-squared	**0.35**	**0.38**	**0.38**	**0.38**	**0.44**	**0.39**

Standard errors are in parentheses.
+ Significant at 10%; * significant at 5%; ** significant at 1%

Table 3. Random Effects Estimates. The dependent Variable is growth rate of real per capita GDP

	(1)	(2)	(3)	(4)	(5)	(6)
Initial GDP	-0.450 (0.155)**	-0.538 (0.202)**	-0.425 (0.198)*	-0.488 (0.206)*	-0.713 (0.188)**	-0.492 (0.179)**
Gov. cons.	-0.041 (0.021)+	-0.035 (0.027)	-0.043 (0.028)	-0.038 (0.027)	-0.037 (0.025)	-0.037 (0.025)
Investment	0.149 (0.017)**	0.171 (0.023)**	0.177 (0.023)**	0.176 (0.023)**	0.153 (0.022)**	0.154 (0.022)**
Export growth	0.146 (0.014)**	0.138 (0.020)**	0.138 (0.020)**	0.138 (0.020)**	0.142 (0.019)**	0.144 (0.019)**
Schooling	0.277 (0.085)**	0.316 (0.110)**	0.311 (0.111)**	0.317 (0.109)**	0.218 (0.104)*	0.224 (0.104)*
Freedom	-0.258 (0.087)**					
Rule of law		0.444 (0.133)**				
corruption			0.342 (0.141)*			
Exprop. Risk						0.555 (0.096)**
Repud. Risk					0.687 (0.102)**	
Bureau. Qual.				0.356 (0.143)*		
Observations	**540**	**345**	**345**	**345**	**345**	**345**
Number of countries.	**100**	**90**	**90**	**90**	**90**	**90**

Standard errors are in parentheses; + Significant at 10%; * significant at 5%; ** significant at 1%

A noticeable difference in the results is with the fixed effects estimates. Only three of the six indicators of governance – the rule of law index, the index of risk of repudiation of contacts, and the index of the risk of government expropriation of private

property- have the expected signs and are statistically significant. The other three indicators are statistically insignificant and have the wrong signs. What explains the difference in results between the system GMM estimates and the fixed effects estimates is not clear, but we suspect that since some of the indicators of governance have a limited within-country variation, the fixed effects transformation may be causing the unexpected results in Table 2.

The random effects estimates, on the other hand, are very similar to the system GMM estimates. All the indicators of governance have the expected signs and are statistically significant. The magnitudes of the estimates are also comparable with the system GMM estimates.

The Sub-Saharan Africa Sub-sample

Table 4 reports regression estimates for the Sub-Saharan Africa sub-sample. Due to insufficient data on most indicators of quality of governance, we use only the index of freedom to capture the effect of quality of governance in this sub-sample analysis. The results indicate a bigger magnitude of the adverse effects of poor governance compared to the full sample estimates.

Specifically, based on the system GMM estimate in Table 4, a one standard deviation increase in the index of freedom (decline in political rights and civil liberties) is associated with a 0.97 (-0.704x1.378)[42] percentage points decline in the rate of growth in

[42] This estimate is based on the standard deviation of "Freedom" for the Sub-Saharan Africa sub-sample.

per capita GDP. This contrasts with a decline of about 0.44 (-0.228x1.92)[43] percentage point for a one-standard deviation increase in the index of freedom for the full sample.

Table 4. Regression estimates for the Sub-Saharan Africa Sub-Sample. The Dependent Variable is Growth in real per capital GDP.

	Fixed Effects (2)	**Random Effects (3)**	**Dynamic Panel (4)**
Initial GDP Per Capita	-0.413 (0.110)**	-0.824 (0.446)+	-0.306 (0.147)*
Gov't Consumption	-0.092 (0.064)	-0.095 (0.051)+	0.041 (0.055)
Investment	0.147 (0.038)**	0.137 (0.032)**	0.024 (0.037)
Export Growth	0.108 (0.025)**	0.119 (0.024)**	0.183 (0.025)**
Years of Schooling	0.568 (0.478)	0.488 (0.239)*	1.368 (0.613)*
Index of Freedom	-0.494 (0.221)*	-0.785 (0.182)**	-0.704 (0.220)**
Observations	**148**	**148**	**148**
R-squared	**0.46**		
Countries	**29**	**29**	**29**

Robust standard errors in parentheses ; + Significant at 10%; * significant at 5%; ** significant at 1%

Thus, the simple conclusion from the result is that the cost of poor governance as indicated by low levels of civil liberties and political rights is higher in Sub-Saharan Africa relative to the other regions of the world. Coefficient estimates on the control

[43] Although the "freedom" coefficient (Table 1) is statistically insignificant in the full sample, it compares in magnitude with the random effects estimate in Table 3.

variables are similar to the full sample estimates except for some relatively minor differences in magnitudes.

Direct versus Indirect Growth Effects of Governance

As discussed in the preceding Chapter, we attempt to separate the total growth effect of governance into the direct effect and the indirect effect. The indirect effect is one channeled through the composition of government expenditures, while the "direct" effect is channeled through other mechanisms such as investment, productivity, etc.

Table 5 presents an instrumental variables approach estimates of the growth equation with shares of expenditures on education, health, and defense as additional right-hand-side variables. In specification (4) of Table 5, after controlling for all the three expenditures shares, the indicator of governance is statistically insignificant. However, we notice that the magnitude of the estimate is quite substantial, but with an equally substantially big standard error. This causes us to suspect the presence of multicollinearity as a possible cause of inflated standard errors.

Nonetheless, we compute the total growth effect of governance as described in equation (4.15). Table 5 presents second-stage instrumental variables approach estimates, while Table 6 reports the first-stage results. Based on these results and equation (4.15), the net effect of governance on growth in per capita income is -0.671+ [(-0.244 x -0.397) + (-0.148 x -0.33)+(0.167 x 1.772)] = -0.229. This implies that a one point increase in the indicator of political freedoms (meaning declining freedoms), is associated with a 0.23 percentage point decline in the growth of real per capita GDP. The magnitude of the coefficient turns out to be very close to the coefficient on "freedom" in Tables 1 and 3,

where expenditure shares are excluded from the regressions, which should be the expected result.

Table 5. Instrumental Variables Results: The Dependent Variable is Growth in Real per Capita GDP

	(1)	**(2)**	**(3)**	**(4)**
Initial GDP	-0.313 (0.133)*	-0.331 (0.170)+	-0.433 (0.162)**	-0.605 (0.275)*
Govt. consumption	-0.037 (0.028)	-0.038 (0.030)	-0.044 (0.030)	-0.026 (0.031)
Investment	0.160 (0.029)**	0.143 (0.030)**	0.154 (0.031)**	0.142 (0.032)**
Export Growth	0.243 (0.026)**	0.241 (0.026)**	0.240 (0.029)**	0.238 (0.028)**
Schooling	0.209 (0.101)*	0.248 (0.096)*	0.206 (0.101)*	0.144 (0.105)
Freedom	-0.183 (0.106)+	-0.359 (0.093)**	-0.677 (0.371)+	-0.671 (0.642)
Share of Education	-0.116 (0.048)*			-0.244 (0.069)**
Share of Health		-0.051 (0.101)		-0.148 (0.137)
Share of Defense			0.154 (0.188)	0.167 (0.287)
Observations	**312**	**311**	**294**	**293**

Robust standard errors in parentheses; + significant at 10%; * significant at 5%; ** significant at 1%

Table 6. IV First Stage Estimates

	Dependent Variable		
	Share of Educ. Expenditure	**Share of Health Expenditure**	**Share of Defense Expenditure**
Freedom	-0.397 (0.210)+	-0.330 (0.182)+	1.772 (0.186)**
Percent Pop 0-14 years	0.410 (0.022)**		
Percent Pop 65+ years		0.632 (0.045)**	
Fertility Rate		1.039 (0.173)**	
Percent Pop 15-64 years			0.077 (0.010)**
Observations	**392**	**391**	**365**
R-squared	**0.86**	**0.68**	**0.70**

Robust standard errors in parentheses; + Significant at 10%; * significant at 5%; ** significant at 1%

Ironically, this result suggests that the indirect channel through the composition of public expenditures actually reduces the adverse effect of poor governance on economic growth. Whereas the direct effect (Model 4 in Table 5) is -0.671, the net adverse effect of poor quality governance is -0.229 due to the positive indirect effect of 0.442.

In Table 7 we present system GMM estimates for the growth equation while controlling for expenditure composition. Based on the estimates in model 5 of Table 7 and first-stage results in Table 6, the net effect of governance on the rate of growth in real per capita GDP (also computed from equation 4.15) is -0.403, implying a positive indirect effect 0.22 of a percentage point. This suggests that a one point increase in the

index of freedom (declining freedom) is associated with a 0.4 percentage point decline in growth.

Table 7. Two-Step System GMM Estimates: The Dependent Variable is Growth in Real Per Capita GDP.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Initial GDP	-0.793 (0.397)*	-0.840 (0.401)*	-1.220 (0.288)**	0.305 (0.274)	-0.664 (0.220)**
Govt. Con.	-0.093 (0.033)**	-0.057 (0.029)+	-0.153 (0.040)**	-0.137 (0.033)**	-0.087 (0.019)**
Invest	0.076 (0.033)*	0.056 (0.029)+	0.075 (0.039)+	0.111 (0.023)**	0.139 (0.016)**
Export growth	0.399 (0.051)**	0.385 (0.053)**	0.327 (0.053)**	0.261 (0.037)**	0.294 (0.030)**
Schooling	0.696 (0.215)**	0.610 (0.163)**	0.494 (0.148)**	0.302 (0.176)+	0.436 (0.110)**
Freedom	-0.411 (0.140)**	-0.493 (0.204)*	-0.862 (0.206)**	-0.287 (0.137)*	-0.650 (0.112)**
Share of Education	-0.031 (0.042)				-0.039 (0.020)+
Share of Health		-0.046 (0.022)*			-0.117 (0.023)**
Share of Defense			0.111 (0.049)*		0.109 (0.022)**
Share of Capital				0.006 (0.024)	
Observations	**312**	**311**	**294**	**358**	**293**
Countries	**69**	**68**	**66**	**73**	**66**
Hansen Test	**0.567**	**0.589**	**0.088**	**0.543**	**0.397**
AR(1)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
AR(2)	**0.505**	**0.356**	**0.282**	**0.873**	**0.714**

Standard errors in parentheses; + Significant at 10%; * significant at 5%; ** significant at 1%

Quality of Governance and Composition of Public Expenditure

In this section of the Chapter, we report and discuss the results of our analysis of the quality of governance and the composition of public expenditure. We begin our discussions with the functional allocation of expenditure and later we discuss causal effects of governance on capital expenditure.

Functional Composition of Expenditure

Our analysis of the functional allocation of public spending is based on three major functional public spending categories – health, education, and defense. As discussed in Chapter IV, we estimate the effect of governance on the functional composition of expenditures using two estimators. The first is the Zellner (1962) seemingly unrelated procedure, and the second is the quasi maximum likelihood estimator proposed by Papke and Wooldridge (1996).

These procedures are chosen to deal with two separate econometric issues. The obvious one is that the dependent variables in equations (4.23) are shares of total public spending and therefore bounded between zero and one. The send issue, also discussed in Chapter IV, is that the error processes in equations (4.23) might be correlated across equations.

In Table 8, we present estimates from a seemingly unrelated regressions (SUR) model. It is important to note that the SUR model only deals with the second of the two empirical issues stated above – the cross equation correlation in error processes. Nonetheless, the results in Table 8 provide a good idea of the direction (and perhaps the

magnitudes) of the effects of governance on the composition of expenditures. For that reason, we provide a brief discussion of these estimates.

Table 8. SUR Estimates for Expenditure Composition.

	Dependent Variable		
	Health Expend. Share	**Education Expend. Share**	**Defense Expend. Share**
GDP per Capita	-0.008 (0.004)*	-0.006 (0.0035)+	-0.028 (0.005)**
Budget Balance	0.0004 (0.0001)**	0.001 (0.0001)**	-0.001 (0.0002)**
Urbanization	0.000 (0.000)		-0.002 (0.0003)**
Density			0.000 (0.000)**
Pop. Under 15 years		0.001 (0.0004)*	
Pop. 15-64 years			-0.0002 (0.0006)
Pop. Over 65 years	-0.001 (0.001)		
Pop. Growth rate	0.0001 (0.0014)	-0.007 (0.002)**	0.007 (0.0019)**
Index of freedom	-0.003 (0.001)**	-0.003 (0.001)**	0.005 (0.0012)**
N	**1402**	**1402**	**1402**

+ Significant at 10%; * significant at 5%; ** significant at 1%; Standard errors in parenthesis.

The SUR estimates suggests that lower political freedoms are associated with smaller shares of spending on education and health and higher shares of public spending

devoted to defense. This is agrees with the rent-seeking and rent extraction hypothesis discussed earlier. Specifically, a one standard deviation increase in the indicator of political freedoms (declining freedom) is associated with a 0.56 (-0.003 x 100 x 1.86) percentage point decline the share of education spending in total expenditures and a 0.3 (-0.003 x 100 x 1.86) percentage point decline in the share of health expenditure in total public spending. On the other hand, a one point increase in the indicator of political freedom is associated with a 0.93 (0.005 x 100 x 1.86) percentage point increase in the share of defense expenditure in total spending.

Table 9 presents estimation results of the seemingly unrelated (SUR) model with a log-odds transformation of the dependent variables as shown in equations (4.24). As discussed in Chapter IV, we transform the dependent variables to deal with the fractional nature of the dependent variable. For each of the equations, Table 9 reports the coefficient estimates and the "marginal effects" computed from equation (4.18).
We find that political rights and civil liberties positively impact health expenditure as a share of total public expenditure and education expenditure as a share of total public expenditure. However, political freedom has a negative impact on defense spending as a share of total public expenditure. This confirms the results in Table 8.

A one standard deviation increase in the index of political freedom (implying a decline in freedom) is associated with a 0.56 (1.86 x 100 x 0.003) percentage point decline in health expenditure as a share of total public expenditure.[44] A one standard deviation increase in the index of political freedom is associated with a 0.37 (1.86 x 100 x 0.002) percentage point decline in public expenditure on education as a share of total

[44] Marginal effects are computed at the mean values of the dependent variable.

public expenditure. On the other hand, a one standard deviation increase in the index of political freedom is associated with a 1.11 (1.86 x 100 x 0.006) percentage point increase in defense spending as a share of total public spending.

Table 9. SUR Estimates for Expenditure Composition with the Log-odds transformation.

Dependent Variable	**Health (1)**		**Education (2)**		**Defense (3)**	
	Coeff.	**M/ Effect** $(\Delta y/\Delta x)$	**Coeff.**	**M/Effect** $(\Delta y/\Delta x)$	**Coeff.**	**M/Effect** $(\Delta y/\Delta x)$
GDP per Capita	-0.35 (0.067)**	-0.023	-0.158 (0.033)**	-0.017	-0.345 (0.052)**	-0.031
Budget Balance	0.01 (0.002)**	0.001	0.009 (0.001)**	0.001	-0.005 (0.002)*	-0.000
Urbanization	0.005 (0.004)	0.000			-0.021 (0.003)**	-0.002
Density					0.000 (0.000)**	0.000
Pop. Under 15 years			0.012 (0.004)**	0.001		
Pop. 15-64 years					0.015 (0.006)**	0.001
Pop. Over 65 years	0.0363 (0.022)+	0.002				
Pop. Growth rate	-0.029 (0.025)	-0.002	-0.049 (0.013)**	-0.005	0.067 (0.019)**	0.006
Index of freedom	-0.05 (0.016)**	-0.003	-0.018 (0.008)*	-0.002	0.061 (0.012)**	0.006
N	**1402**		**1402**		**1402**	

Standard errors in parenthesis; ** denotes significance at 99 percent; * denotes significance at 95 percent; + denotes significance at 90 percent.

Our interpretation of these results is based on the hypotheses stated in Chapter IV. Countries with lower political rights and civil liberties do not elect the leaders who make

budgetary decisions, and therefore public spending will be structured to maximize the leaders' utility. In a dictatorial regime, defense spending is crucial to protect the leaders' power. This might explain the relative increase in defense spending. This increase in defense spending is taking away from health and education spending – two sectors that are not as crucial to the political survival of those in power. In a more democratic society, citizens indirectly choose the allocation of public resources through elections. To the extent that health and education matter more relative to defense to a typical citizen, more political freedoms will be associated with increased spending on health and education.

This is what the results in Table 9 show – a bigger share of the public budget going to defense spending and a smaller share of the budget devoted to education and health as the level of political freedoms decline. Keefer and Khemani (2003) discuss the effect of incentives to politicians on the provision of social services. They conclude that health and education services are most vulnerable to imperfections in the political market. Keefer and Khemani (2003) argue that political market imperfections "help to explain a well-known distortion in public spending: the preference for governments to spend on targeted programs, such as government jobs or infrastructure investment, rather than on improvements in broad social services." As our results in Table 9 suggest, with a complete lack of a political market, these distortions could be exacerbated.

We control for differences in income across countries using GDP per capita. Notice from Table 9 that the marginal effects on this variable for all the three equations are negative and statistically significant. The results indicate lower spending shares in each of the categories as income increases. This result runs contrary to Sanz and

Velasquez (2002) who, in a sample of OECD member countries, find positive and high income elasticity in regard to health.

Results also suggest that relative spending on health and education is positively impacted by the government budget balance (Revenues minus expenditure) as a percentage of GDP. We find that a one standard deviation increase in the budget balance is associated with a 0.58 (0.001 x 100 x 5.79) of a percentage point increase in relative spending on both health and education. However, the results in Table 9 show a negative impact of the budget balance on relative spending on defense. A one standard deviation increase in the budget balance is associated with a decline in the share of defense expenditures by 0.26 (0.00045 x 100 x 5.79) of a percentage point. The explanation for this result is not clear, but it could be the case that defense spending is, at least in part, financed by increasing central government deficits.

Population density has a positive causal impact on defense spending as a percentage of total spending, a result similar to one obtained by Sanz and Velasquez (2002). A one standard deviation increase in population density is associated with a 1.45 (2.1E-5 x 700.29 x 100) percentage points increase in the share of defense spending. Sanz and Velasquez (2002) interpret this positive relationship to mean that "security increases in importance in countries where population is concentrated."

However, the percentage of the total population leaving in urban areas, which is positively correlated with population density, is found to have a negative relationship with the share of defense spending in total public spending. This may be due to the public good nature of national defense. In other words, having a relatively big percentage of the

population concentrated in urban centers may reduce spending by focusing resources in a few urban areas other than spreading them through out the entire country.

Further, as suggested in previous studies, the age structure of the population significantly affects the composition of public expenditure. The literature suggests that a younger population is expected lead to a higher share of education expenditure in total public spending. A standard deviation increase in the percentage of people below 15 years of age is associated with a 0.97 (0.001 x 100 x 9.65) of a percentage point increase in the relative share of education expenditure.

The percentage of total population over the age of 65 years, as expected, is associated with a relatively bigger share of health expenditure in total public expenditure. A one standard deviation increase in the share of total population over 65 years of age is associated with a 0.91 (0.002 x 100 x 4.57) percentage point increase in the relative share of health expenditure.

Likewise, the share of total population between the ages of 15 and 64 years is found to have a positive causal impact on defense spending. The share of defense expenditure in total public expenditure goes up by about 0.59 (0.001 x 100 x 5.88)) of a percentage point as a result of a one standard deviation increase in the percentage of the total population between the ages of 15 and 64 years. One plausible explanation for this relationship is that most illegal and rebellious activities that might threaten the security of the State are likely to be carried out by individuals between 18 and 35 years of age (Marlow and Shiers 1999).

Population growth rate has a negative impact on the share of education expenditure, and a positive impact on the share of defense spending. A one standard

deviation increase in the population growth rate is associated with a 0.56 (-0.005 x 100 x 1.12) percentage point decline in the share of education expenditure and a 0.67 (0.006 x 100 x 1.12) of a percentage point increase in the share of defense spending. The impact of population growth rate on the share of health expenditure is negative but statistically insignificant. This result suggests that a rapidly increasing population demands more spending on defense to guard against potential rebellious activities that may be associated with a higher and increasing population. However, this spending comes at a cost in terms of spending on education and possibly health. Put differently, defense spending crowds-out spending on education and health.

Results obtained from the Quasi-maximum likelihood (QML) methods suggested by Papke and Wooldridge (1996) are, for the most part, similar to the SUR results discussed above. The QML results for the functional composition of expenditures are presented in Table 10. The index of political freedom has the expected negative coefficient in the shares of health and education expenditures regressions, and a positive coefficient in the share of defense spending equation. Specifically, a one standard deviation increase in the index of freedom (declining political freedoms) is associated with a 0.56 (-0.003 x 100 x 1.86) percentage point decline in the share of health expenditures, a 0.74 (-0.004 x 100 x 1.86) percentage point decline in the share of education expenditure and a 2.05 (0.011 x 100 x 1.86) percentage points increase in the share of defense expenditures.

Table 10. Quasi-maximum Likelihood (QML) Estimates for Expenditure Composition.

Dependent Variable	Share of Health (1)		Share of Education (2)		Share of Defense (3)	
	Coeff.	M/ Effect	Coeff.	M/ Effect	Coeff.	M/Effect
GDP per Capita	-0.067 (0.052)	-0.006	-0.022 (0.030)	-0.005	-0.313 (0.049)**	-0.076
Budget Balance	0.008 (0.002)**	0.001	0.01 (0.001)**	0.002	-0.009 (0.002)**	-0.002
Urbanization	0.006 (0.004)	0.001	0.003 (0.002)	0.001	-0.01 (0.003)**	-0.002
Density					0.000 (0.000)**	0.000
Pop. Under 15 years			0.006 (0.003)	0.001		
Pop. 15-64 years					0.001 (0.005)	0.000
Pop. Over 65 years	0.039 (0.019)*	0.003				
Pop. Growth rate	-0.017 (0.019)	-0.001	-0.049 (0.012)**	-0.012	0.066 (0.016)**	0.016
Index of freedom	-0.038 (0.012)**	-0.003	-0.019 (0.007)**	-0.004	0.046 (0.011)**	0.011
N	**1512**		**1542**		**1407**	

Standard errors in parenthesis; ** denotes significance at 99 percent; * denotes significance at 95 percent; + denotes significance at 90 percent.

Public Capital Expenditure and Quality of Governance

In this subsection, we discuss results of our analysis of the effect of quality of governance on the share of public capital expenditure. Table 11 presents quasi-maximum likelihood estimates for the share of public capital expenditure.

Table 11. Quasi-maximum likelihood Estimates. The dependent variable is Capital Expenditure as a Percentage of total Public Expenditures

	(1)		(2)		(3)	
Variable Name	**Coeff.**	**M/effect**	**Coeff.**	**M/Effect**	**Coeff.**	**M/Effect**
GDP Per capita	-0.272**	-.063	-0.284**	-0.071	-0.282**	-0.070
	(0.025)		(0.039)		(0.037)	
Private Investment	0.027**	0.006	0.039**	0.010	0.038**	0.009
	(0.002)		(0.003)		(0.003)	
Budget Balance	0.018**	0.004	0.027**	0.007	0.025**	0.006
	(0.002)		(0.004)		(0.004)	
Rate of Urbanization	-0.006**	-0.001	-0.006**	-0.001	-0.006**	-0.001
	(0.001)		(0.001)		(0.001)	
Population Growth Rate	0.132**	0.031	0.165**	0.041	0.168**	0.042
	(0.017)		(0.024)		(0.024)	
Index of Freedom	0.074**	0.017				
	(0.010)					
Rule of law Index			-0.041+	-0.010		
			(0.022)			
Index of Corruption					-0.046*	-0.011
					(0.02)	
N	**1816**		**956**		**956**	

Standard errors in parenthesis; *** denotes significance at 99 percent; ** denotes significance at 95 percent; * denotes significance at 90 percent.

We use three indicators of governance – political freedom, maintenance of rule of law, and perceptions of corruption – each in a separate regression. For each of the regressions, Table 11 reports both the coefficient estimates and marginal effects computed from equation (4.22).

We find a negative impact of political freedom on the share of public capital expenditure. That is, lack of (or less) political freedom is associated with higher shares of public capital expenditure in total public spending. Recalling that our index of freedom is measured on a scale of 1 to 7, with 7 being the lowest level of freedom, the positive coefficient on the index of freedom should be interpreted as a negative impact of a higher level of political freedom on the dependent variable. A one standard deviation increase in the index of freedom (declining freedom) is associated with a 3.16 (0.017 x 100 x 1.86) percentage points increase in the relative share of public capital expenditure in total public spending.

This supports hypothesis (3) as stated in the previous Chapter and the theoretical propositions discussed in Keefer and Khemani (2003). Countries under dictatorships are characterized by lack of public scrutiny and an effective media that probes government operations. In such cases, we expect political leaders to maximize their own private economic rents by investing more public resources in big investment ventures that are associated with big rents – commissions and or bribes – and no public utility.

In the second specification we include the rule of law index as an indicator of quality of governance. The results of this specification are consistent with the first specification. An improvement in the maintenance of the rule of law is associated with a smaller share of public capital spending in total public spending. Specifically, a one

standard deviation increase in the index of rule law (improvement in the maintenance of rule of law) is associated with a 1.62 (-0.01 x 100 x 1.62) percentage points decline in the share of public capital expenditure in total public expenditure.

We get consistent results when an index of corruption is used to measure the quality of governance. A one point increase in the index of corruption (lower corruption) is associated with a 1.63 (-0.011 x 100 x 1.48) percentage points decline in the share of public capital expenditure in total public expenditure. Our results agree with Tanzi and Davoodi (1997), who find that corruption significantly increases public investment spending. However, in a study of 123 non-OECD countries, Sturm (2001) does not find any evidence of a causal effect between political and institutional variables on public capital expenditure.

We include GDP per capita as an explanatory variable to control for differences in the level of development. Results indicate that low-income countries are associated with relatively bigger shares of capital expenditure in total expenditure. We also find that private investment stimulates public capital spending. A one standard deviation increase in private investment as a share of GDP is associated with a 4.12 (0.006 x 100 x 6.86)) to 6.86 (0.01 x 100 x 6.86) percentage points increase in the share of public capital expenditure in total expenditure. A plausible explanation for this result is that public investment is complementary to private investment through the provision of infrastructure necessary for profitable private investment.

Public capital spending is also positively impacted by the budget balance. A one standard deviation increase in the budget balance as a percentage of GDP is associated with a 2.3 (0.004 x 100 x 5.79) to 4.05 (0.007 x 100 x 5.79) percentage points increase in

the share of capital expenditure in total public expenditure. When a government is running a budget deficit, it is politically easier to cut capital spending as public investment tends to be more discretionary spending compared to recurrent expenditures. On the other hand, when the government budget is in a surplus, capital spending is expected to increase relative to recurrent expenditure. For example, wages and salaries form a big part of a typical recurrent budget. Since this part of the budget is, for the most part, not adjusted every budget year, recurrent expenditures will respond less to budget surpluses relative to public investment. This might explain the positive relationship between the budget balance and the share of capital expenditures in total spending observed in Table 11 and in Sturm (2001).

The level of urbanization, measured as the percentage of total population leaving in urban areas, has a negative impact on the share of public capital spending in total public spending. A one standard deviation increase in the level of urbanization is associated with a 2.5 (-0.001 x 100 x 24.75) percentage points decline in the share of capital expenditure in total public expenditure. As Sturm (2001) explains, rural areas are likely to be more in need of public investment for the provision of infrastructure. As a result, predominantly rural economies are associated with a bigger share of public capital expenditure in total public expenditure.

Population growth is associated with increases in the share of public capital expenditure in total expenditure. A rapidly increasing population puts upward pressure on demand for health, education and public infrastructure, and thus higher capital spending in these sectors. Specifically, a one standard deviation increase in the rate of population

growth is associated with a 3.5 (0.031 x 100 x 1.12) to 4.7 (0.042 x 100 x 1.12) percentage points increase in the share of capital expenditure in total public expenditure.

In Table 12, we present results from the log-odds (logistic) transformation estimation of the specifications reported in Table 11 and discussed above. Results in Table 12 are very similar to the quasi-maximum likelihood results reported in Table 11. The signs on the coefficients match and the magnitudes of the marginal effects are comparable. As such, for sake of brevity, we do not do a detailed discussion of these results. The marginal effects in Table 12 are computed from equation (4.18) with y equal to the mean share of capital expenditure in total public expenditure.

Table 12. Log-odds transformation Estimates. The dependent variable is Capital Expenditure as a Percentage of total Public Expenditures

	(1)		(2)		(3)	
Variable Name	**Coeff.**	**M/effect**	**Coeff.**	**M/Effect**	**Coeff.**	**M/Effect**
GDP Per capita	-0.303 (0.024)**	-0.043	-0.244 (0.032)**	-0.034	-0.230 (0.031)**	-0.032
Private Investment	0.021 (0.003)**	0.003	0.047 (0.004)**	0.007	0.045 (0.004)**	0.006
Budget Balance	0.029 (0.003)**	0.004	0.026 (0.005)**	0.004	0.024 (0.005)**	0.003
Rate of Urbanization	-0.012 (0.001)**	-0.002	-0.006 (0.001)**	-0.001	-0.006 (0.001)**	-0.001
Population Growth Rate	0.074 (0.019)**	0.010	0.171 (0.024)**	0.024	0.173 (0.024)**	0.024
Index of Freedom	0.028 (0.014)*	0.004				
Rule of law Index			-0.048 (0.023)*	-0.007		
Index of Corruption					-0.067 (0.023)**	-0.009
N	**1816**		**956**		**956**	

Standard errors in parenthesis; *** denotes significance at 99 percent; ** denotes significance at 95 percent; * denotes significance at 90 percent.

CHAPTER VI

CONCLUSION

In this dissertation, we explored the impact of quality of governance on economic growth using a panel data set from a sample of 100 countries for the period 1971-2000[45]. We employed a dynamic panel data estimator to deal with some of the common problems associated with economic growth studies, namely persistence and endogeneity. Using various indicators of governance from the Freedom House and the Political Risk Group, we found the quality of governance to have a positive and statistically significant impact on the growth rate in real per capital GDP.

Further, we investigated a potential transmission mechanism for the growth effects of governance through the composition of public expenditures. This part of the analysis presents two empirical issues. The first one is the fact that the dependent variables are expenditure shares, and therefore fractional variables. As discussed in Chapter IV, this makes linear models inappropriate. The second issue is the likelihood of cross equation correlation in the error processes. To deal with these problems, the dissertation uses a seemingly unrelated regressions model to estimate the impact of governance on the functional composition of public expenditures. We also attempted to deal with the empirical issues that result from the fractional nature of the dependent variables by using the log-odds transformation as well as quasi-maximum likelihood methods.

[45] The sample size is smaller in some regressions.

We find that a higher quality of governance is associated with higher spending on education and health, and low spending on defense, everything else constant. As noted earlier in the dissertation, this is consistent with the rent-seeking hypothesis in the sense that rent-seeking decision-makers will choose to allocate public resources in sectors that maximize their private rents at the expense of the common good. However, the extent of rent-extraction will depend on the incentive structures within which decisions are made. We argue that social sectors (such as education and health) provide less opportunity for rent extraction due to the relatively transparent nature of most activities in these sectors. Defense spending, on the other hand, is less open to public scrutiny and thus provides better opportunities to extract rents. With better monitoring systems and a democratic environment, we should expect decision-makers to put relatively more emphasis on social welfare rather than rents as the wellbeing of society in general determines the odds of maintaining power. This explains why better governance is associated with more spending on sectors with a direct impact on social welfare (education and health) and less spending on defense.

In regard to the composition of expenditures by economic characteristics of the expenditure (capital versus recurrent), we estimated the impact of governance on the share of capital expenditure using quasi-maximum likelihood methods and the log-odds transformation approach. The results of this empirical investigation suggest that high quality governance is associated with a smaller share of capital expenditures in total spending. This finding is also in agreement with the rent-seeking hypothesis. Public capital investment usually involves huge and complex projects that are often difficult for the public or media to monitor. For this reason, poor governance provides more

incentives for decision-makers to spend relatively more on public investment. This also rhymes with the finding of the World Bank public expenditure reviews that report spending imbalances in developing countries in favor of capital expenditures.

These findings could have implications to the appropriate design of reforms, especially in developing countries. If governance affects the composition of government expenditures, then reforms to streamline budgetary processes or systems in developing countries to ensure transparency and "optimal" allocation of public resources should, perhaps, begin with reforms in the rules (or the incentive structure) that govern the decision-making process. How governments allocate public resources has a significant impact on both current and future growth rates, poverty levels, and overall social welfare of their citizens. For example, less spending on education affects the future quality of human capital, and thus economic growth.

In addition to the empirical analysis, the dissertation develops a simple model based on Devaranjan, et al. (1996) that incorporates the quality of governance and the composition of public expenditures in a simple growth model. Theoretically, we find that the total impact of the quality of governance is ambiguous, but potentially depends on, at least in part, the composition of public expenditures.

APPENDIX A

THEORETICAL APPENDIX

The problem of the individual is to maximize utility:

$$U = \int_0^{\infty} u(c) e^{-\rho t} dt \text{; where u' >0, and u'' <0} \quad (1a)$$

Subject to:

$$\dot{k} = (1-\tau)y - c \quad (2a)$$

Where, k is private capital person, and c is consumption per person.

Output per person, y is given by:

$$y = Vf(k, g_1, g_2) = Vk^{\alpha} g_1^{\beta} g_2^{\gamma} \quad (3a)$$

$\alpha, \beta, \gamma \geq 0$; $\alpha + \beta + \gamma = 1$; and following Martinez-Vazquez and McNab (2005), we define $V = A\psi$ as a product of the level of technology, A, and a measure of quality of institutions or governance, ψ.

Let's assume that the government runs a balanced budget. That is:

$$\tau y = g_1 + g_2 = g \quad (4a)$$

Where g_1 and g_2 are two types of government expenditure (per person), g is total government expenditure per person, and τ is the tax rate.

If φ is the proportion of g spent on g_1, then:

$g_1 = \varphi g$; and $g_2 = (1-\varphi)g$ (5a)

Substituting equations 3a, 4a, and 5a into 2a, yields the following equation.

$$\dot{k} = (1-\tau)Vk^{\alpha}(\varphi g)^{\beta}((1-\varphi)g)^{\gamma} - c \qquad (6a)$$

Once again, the objective of an individual consumer is to maximize (1a) subject to (6a).

We set-up the Hamiltonian function as follows:

$$H = u(c)e^{-\rho t} + v\{(1-\tau)Vk^{\alpha}(\varphi g)^{\beta}((1-\varphi)g)^{\gamma} - c \qquad (7a)$$

$$\frac{dH}{dc} = u'(c)e^{-\rho t} - v = 0 \qquad (8a)$$

We now differentiate H with respect to k and set the result equal to $\dot{v}$:

$$\frac{dH}{dk} = v(1-\tau)V\alpha k^{(\alpha-1)}\varphi^{\beta}(1-\varphi)^{\gamma} g^{(\beta+\gamma)} = -\dot{v} \qquad (9a)$$

Now we differentiate (8a) with respect to time, t.

$$\rightarrow \dot{u}'(c)e^{-\rho t} - \rho e^{-\rho t}u'(c) = \dot{v} \qquad (10a)$$

Substitute (10a) into (9a):

$$e^{-\rho t}[\dot{u}'(c) - \rho u'(c)] = -v(1-\tau)V\alpha k^{(\alpha-1)}\varphi^{\beta}(1-\varphi)^{\gamma} g^{(\beta+\gamma)} \qquad (11a)$$

From equation (8a), substitute for v in (11a);

$$\rightarrow e^{-\rho t}[\dot{u}'(c) - \rho u'(c)] = u'(c)e^{-\rho t}\mathrm{B} \qquad (12a)$$

Where B = $(1-\tau)V\alpha k^{(\alpha-1)}\varphi^{\beta}(1-\varphi)^{\gamma} g^{(\beta+\gamma)}$

From (12a),

$$[\dot{u}'(c) - \rho u'(c)] = u'(c)\,\mathrm{B}$$

$$\rightarrow \frac{\dot{u}'(c)}{u'(c)} = \rho - B \qquad (13a)$$

$$\text{Let } u(c) = \frac{c^{1-\sigma} - 1}{1-\sigma} \qquad (14a)$$

$$\rightarrow u' = c^{-\sigma} \text{ ; and } u'' = -\sigma * c^{-\sigma-1} \tag{15a}$$

$$\text{Now, } \dot{u}'(c) = \frac{du'}{dc} * \frac{dc}{dt} = u''\dot{c} \tag{16a}$$

Substituting (15a) and (16a) into (13a) yields:

$$\frac{-\sigma * c^{-\sigma-1}\dot{c}}{c^{-\sigma}} = \frac{-\sigma * \dot{c}}{c} = \rho - B$$

$$\rightarrow \frac{\dot{c}}{c} = \frac{B-\rho}{\sigma} \tag{17a}$$

Recall that B = $(1-\tau)V\alpha k^{(\alpha-1)}\varphi^{\beta}(1-\varphi)^{\gamma} g^{(\beta+\gamma)}$

$$\rightarrow \text{Let } \mu = \frac{\dot{c}}{c} = \frac{(1-\tau)V\alpha k^{(\alpha-1)}\varphi^{\beta}(1-\varphi)^{\gamma} g^{(\beta+\gamma)} - \rho}{\sigma} \tag{18a}$$

Equation (18a) represents the rate of growth in consumption.

APPENDIX B

THE DYNAMIC PANEL ESTIMATORS[46]

We begin with a simple autoregressive model:

$$y_{it} = \alpha y_{i,t-1} + u_{it};\ i = 1,...,N;\ t = 1,...,T \qquad (1b)$$

And $u_{it} = c_i + v_{it}$

We first difference (1a) to eliminate the individual effects, and obtain:

$$y_{it} - y_{i,t-1} = \alpha(y_{i,t-1} - y_{i,t-2}) + (v_{it} - v_{i,t-1}) \qquad (2b)$$

Since we have $(y_{i,t-1} - y_{i,t-2})$ on the right-hand side, the fist period we observe is $t = 3$.

That is:

$y_{i3} - y_{i2} = \alpha(y_{i2} - y_{i1}) + (v_{i3} - v_{i2})$.

For this first observable period, y_{i1} is a valid instrument for $(y_{i2} - y_{i1})$ because it's highly correlated to $(y_{i2} - y_{i1})$ but uncorrelated to $(v_{i3} - v_{i2})$. For the second observable period, t = 4, both y_{i1} and y_{i2} are valid instruments for $(y_{i3} - y_{i2})$ since they are both uncorrelated with $(v_{i4} - v_{i3})$. Successive periods through period $t = T$ yield a set of instruments given by $(y_{i1}, y_{i2}, ...y_{i,T-2})$.

If the matrix of instruments, $Z = (Z_1^{'}, Z_2^{'}, ..., Z_N^{'})$ then we can define:

$$Z_i = \begin{bmatrix} (y_{i1}) & & & 0 \\ & (y_{i1}, y_{i2}) & & \\ & & .. & \\ 0 & & & (y_{i1}, ..., y_{i,T-2}) \end{bmatrix}$$

[46] This section of the Appendix is heavily based on Baltagi (1995) and Behr (2003).

The moment conditions implied by this instrumental procedure are therefore given by:

$$E(Z_i^{'}\Delta v_i) = 0 \tag{3b}$$

Where $\Delta v_i^{'} = (v_{i3} - v_{i2},...,v_{iT} - v_{i,T-1})$

The error term in (2a) is a differenced, which implies that $E(\Delta v_i \Delta v_i^{'}) = \sigma_v^2 (I_N \otimes H)$[47], where,

$$H = \begin{bmatrix} 2 & -1 & 0 & .. & . & 0 \\ -1 & 2 & -1 & .. & . & 0 \\ . & . & . & .. & . & . \\ . & . & . & .. & . & . \\ 0 & 0 & 0 & .. & 2 & -1 \\ 0 & 0 & 0 & .. & -1 & 2 \end{bmatrix} \text{ is } (T-2)\times(T-2).$$

The one-step estimator minimizes

$$J_N = \left(N^{-1} \sum_{i=1}^{i=N} Z_i^{'}\Delta v_i \right)^{'} W_N \left(N^{-1} \sum_{i=1}^{i=N} Z_i^{'}\Delta v_i \right) \tag{4b}$$

$$W_N = W_{N1} = [N^{-1} \sum_i Z_i' H Z_i]^{-1} \tag{5b}$$

$$\hat{\alpha} = [(\Delta y_{-1})^{'} Z (Z^{'}(I_N \otimes H) Z)^{-1} Z^{'}(\Delta y_{-1})]^{-1} \times [(\Delta y_{-1})^{'} Z (Z^{'}(I_N \otimes H) Z)^{-1} Z^{'}(\Delta y)] \tag{6b}$$

The Arellano and Bond (1991) optimal Generalized Methods of Moments (GMM) estimator of α is based on the moment restrictions in equation (3a). It's operationalized by replacing Δv by residuals ($\Delta \hat{v}$) obtained from the preliminary step. This results in the Arellano and Bond (1991) two-step GMM estimator given by the following.

$$\hat{\alpha}_2 = [(\Delta y_{-1})' Z W^{-1} Z' (\Delta y_{-1})]^{-1} [(\Delta y_{-1})' Z W^{-1} Z' (\Delta y)] \tag{7b}$$

[47] See Baltagi (1995), Pages 125-132

Where $W = \sum_{i=1}^{N} Z_i^{'}(\Delta\hat{v}_i)(\Delta\hat{v}_i)^{'} Z_i$ and $\Delta\hat{v}_i = \Delta y_i - \hat{\alpha}\Delta y_{i,-1}$, where $\hat{\alpha}$ is the one-step GMM estimate of α.

The consistent estimate of the asymptotic variance of $\hat{\alpha}_2$ is given by the first term on the right-hand side of (6a). That is,

$$a\,\text{var}(\hat{\alpha}_2) = [(\Delta y_{-1})^{'} Z W^{-1} Z^{'} (\Delta y_{-1})]^{-1} \qquad \text{(8b)}$$

Introducing additional explanatory (exogenous or predetermined) variables changes the matrix of instruments, Z[48].

For $T = 4$, when x is strictly exogenous,

$$Z_i = \begin{bmatrix} y_{i1}, x_{i1}, ..., x_{i4} & 0 \\ 0 & y_{i1}, y_{i2}, x_{i1}, ..., x_{i4} \end{bmatrix}$$

When x is predetermined,

$$Z_i = \begin{bmatrix} y_{i1}, x_{i1}, x_{i2} & 0 \\ 0 & y_{i1}, y_{i2}, x_{i1}, x_{i2}, x_{i3} \end{bmatrix}$$

And when x is endogenous,

$$Z_i = \begin{bmatrix} y_{i1}, x_{i1} & 0 \\ 0 & y_{i1}, y_{i2}, x_{i1}, x_{i2} \end{bmatrix}$$

However, the Arellano and Bond (1991) estimator is inefficient in the presence of weak instruments. Blundell and Bond (1998) suggest an estimator that is a combination of moment conditions for differences and levels. The estimator is referred to as the GMM System Estimator.

[48] See Behr (2003) for details on this.

If X contains endogenous variables such that:

$E(x_{it}v_{is}) \neq 0$ for $i = 1,...,N$ and $s \leq t$, then:

$$Z_i^D = \begin{bmatrix} [y_{i1}, x'_{i1}] & 0 & \cdots & 0 \\ 0 & [y_{i1}, y_{i2,} x'_{i1}, x'_{i2}] & \cdots & 0 \\ 0 & 0 & \ddots & 0 \\ \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & [y_{i1}, y_{i2},..., y_{i,T-2}, x'_{i1}, x'_{i2},..., x_{i,T-1}] \end{bmatrix}$$

$$Z_i^L = \begin{bmatrix} [\Delta y_{i2}, \Delta x'_{i2}] & 0 & \cdots & 0 \\ 0 & [\Delta y_{i2}, \Delta y_{i3} \Delta x'_{i2}, \Delta x'_{i3}] & \cdots & 0 \\ 0 & 0 & \ddots & 0 \\ \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & \cdots & [\Delta y_{i2},..., \Delta y_{i,T-2}, \Delta x'_{i2},..., \Delta x'_{i,T-1}] \end{bmatrix}$$

$$Z_i = \begin{bmatrix} Z_i^D & 0 \\ 0 & Z_i^L \end{bmatrix}$$

The Blundell and Bond (1998) first step Estimator uses the covariance matrix given by:

$$V = Z'AZ = \sum_{i=1}^{N} Z_i' A_T Z_i \qquad (9b)$$

$A = (I_N \otimes G^{D,L})$ Where $G^{D,L} = \begin{bmatrix} H_i^D & 0 \\ 0 & H_i^L \end{bmatrix}$ and

$H_i^D = H$ as given above and $H_i^L = \begin{bmatrix} 1 & 0 & \cdots & 0 \\ 0 & 1 & \ddots & 0 \\ \vdots & \ddots & \ddots & \vdots \\ 0 & 0 & 0 & 1 \end{bmatrix}$

The Two-step GMM estimator uses the residuals of the first step estimation to estimate the covariance matrix $\hat{V}$.

The resulting two-step estimator is given by:

$$\hat{\delta}_{SYM} = (XZ\hat{V}^{-1}Z'X)^{-1}X'Z\hat{V}^{-1}Z'y \qquad (10b)$$

Where X is a matrix of explanatory variables (including lagged values of the dependent variable) for both the first differenced and the levels equations.

Identification Tests[49]

Second-order Serial Correlation

Let $y = X\delta + v$ the first-difference equation. The vector of residuals is given by;

$\hat{v} = y - X\hat{\delta} = v - X(\hat{\delta} - \delta)$, where $\hat{\delta}$ is an estimator in (10b), with an appropriate Z and $\hat{V}^{-1}$.

The consistency of the GMM estimators is based on the assumption that $E(v_{it}v_{i,t-2}) = 0$. Again, v is a vector of first-differenced errors.

The test statistic for the second-order serial correlation, based on residuals from the first-difference equation, is given by:

$$m = \frac{\hat{v}'_{-2}\hat{v}_*}{\hat{v}^{1/2}} \tilde{a} N(0,1) \text{ under the null of } E(v_{it}v_{i,t-2}) = 0 \text{ and}$$

$$\hat{v} = \sum_{i=1}^{N} v'_{i,(-2)}\hat{v}_{i*}v'_{i*}\hat{v}_{i(-2)} - 2\hat{v}'_{-2}X_*(X'ZW_{N2}Z'X)^{-1}X'ZW_{N2}(\sum_{i=1}^{N} Z'_i\hat{v}_i\hat{v}'_{i*}\hat{v}_{i(-2)}$$
$$+ \hat{v}'_{-2}X_* a\hat{\text{var}}(\hat{\delta})X'_*\hat{v}_{-2}$$

[49] These tests are drawn directly from Arellano and Bond (1991).

An asterisk denotes variables that have been trimmed to match the second lag of the first-difference error term.

The Sargan/Hansen Test of Over-identifying Restrictions

The null hypothesis for this test is that instruments are valid in that they are not correlated with the errors in the first-differenced equation. The test statistic is given by the value of the objective function in (4b), evaluated at the optimal second-step GMM estimates obtained from (10b).

Therefore,

$S = N\left(\frac{1}{N}\sum_{i=1}^{N} Z_i'\hat{v}_{i2}\right)' W_{N2}\left(\frac{1}{N}\sum_{i=1}^{N} Z_i'\hat{v}_{i2}\right) \sim \chi_q^2$, with q equal to the total number of instruments minus the number of parameters in the model.

APPENDIX C

THE SEEMINGLY UNRELATED REGRESSIONS (SUR) MODEL

Model Set Up

Suppose the j[th] of the M equations is given by the following.

$y_j = x_j\beta_j + u_j$ for $j = 1,...,M$; y_j is $T \times 1$; x_j is $T \times k$; and u_j is $k \times 1$. The entire set of equations can be represented by:

$$Y = X\beta + U \tag{1c}$$

Or

$$\begin{bmatrix} y_1 \\ . \\ . \\ . \\ y_M \end{bmatrix} = \begin{bmatrix} x_1 & 0 & . & . & . & 0 \\ 0 & x_2 & . & . & . & 0 \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ 0 & 0 & . & . & . & x_M \end{bmatrix} * \begin{bmatrix} \beta_1 \\ . \\ . \\ . \\ \beta_M \end{bmatrix} + \begin{bmatrix} u_1 \\ . \\ . \\ . \\ u_M \end{bmatrix}$$

The variance-covariance matrix of the errors is given by:

$$\Omega = \begin{bmatrix} Eu_1u_1' & . & . & . & Eu_1u_M' \\ . & & . & & . \\ . & & . & & . \\ . & & . & & . \\ Eu_Mu_1' & . & . & . & Eu_Mu_M' \end{bmatrix} \tag{2c}$$

Each diagonal element of the matrix in (2c) is a $T \times T$ variance-covariance matrix of residuals for each equation. The off-diagonal elements are also $T \times T$ block matrices of covariance between errors of pairs of equations.

The efficient estimator of β in equation (1c) is given by:

$$\hat{\beta}_{SUR} = (X'\Omega^{-1}X)^{-1}X'\Omega^{-1}Y \tag{3c}$$

APPENDIX D

THE LOG-ODDS TRANSFORMATION

With $0 < y < 1$, it is reasonable that a logistic model fits the data. That is,

$$y = \frac{1}{1+e^{-X\beta}} \tag{1d}$$

$$\rightarrow \ (1+e^{-x\beta})y = 1$$

$$\rightarrow \ e^{-X\beta} = \frac{1}{y} - 1 = \frac{1-y}{y}$$

$$\rightarrow \quad e^{X\beta} = \frac{y}{1-y}$$

$$\rightarrow \log\left(\frac{y}{1-y}\right) = X\beta \tag{2d}$$

Interpretation of coefficient Estimates from equation (2d)

Following Pindyck and Rubinfeld (1990), we solve for change in y due to a given change in X i.e. $\Delta y/\Delta x$.

$$\Delta \log\left(\frac{y}{1-y}\right) = \hat{\beta}\Delta x$$

$$\Delta \log\left(\frac{y}{1-y}\right) \approx \Delta\left(\frac{y}{1-y}\right) \Big/ \left(\frac{y}{1-y}\right) = \hat{\beta}\Delta x$$

$$= \frac{\Delta y(1-y) - y\Delta(1-y)}{(1-y)^2} \times \frac{(1-y)}{y} = \hat{\beta}\Delta x$$

$$= \frac{\Delta y - y\Delta y + y\Delta y}{(1-y)} \times \frac{1}{y} = \hat{\beta}\Delta x$$

$$= \frac{\Delta y}{y(1-y)} = \hat{\beta}\Delta x$$

$$\rightarrow \frac{\Delta y}{\Delta x} = \hat{\beta}[y(1-y)] \qquad (3d)$$

APPENDIX E

DATA DESCRIPTION AND SOURCES

Table E1. Data Sources

Variable	Variable Description	Primary Data Source
A) Measures of Governance		
Political Rights	A country rating on a scale of 1 to 7 that indicates the degree of political rights in regard to existence of free and fair elections, competitive parties or other political groupings, an opposition that plays a significant role in political decision-making, and the rights of minority groups to self-government. A rating of 1 indicates highest level of political rights (closest to the ideals) suggested in the survey	Freedom in the World 2003; Freedom House
Civil Liberties	A country rating on a scale of 1 to 7 that indicates the degree of civil liberties in regard to aspects such as the degree of freedom of expression, assembly, association, education, religion, and an equitable system of rule of law. A rating of 1 indicates the highest level of civil liberties.	Freedom in the World 2003; Freedom House
Freedom	A simple average of the index of political rights and the index of civil liberties	Computed by the author
Rule of Law	An index on a scale of 0 to 6 that measures perceptions of crime, the effectiveness, independence, and impartiality of the judiciary. In general, it measures the extent to which economic agents respects the rules that govern their interactions. The higher the score, the better the performance of the respective country.	Waseem Mina, 2002 (Data originally obtained from the academic version of the International Country Risk Guide (ICRG) published by the Political Risk Group (PRS))

Corruption	An index on a scale of 0 to 6 that measures perceptions of corruption. Corruption in this context is defined as the exercise of public power for private gain. A higher score indicates lower expectations of corruption.	Waseem Mina, 2002 (Data originally obtained from the academic version of the International Country Risk Guide (ICRG) published by the Political Risk Group (PRS))
Bureaucratic Quality	An index on a scale of 0 to 6 that measures bureaucratic delays and the general effectiveness of the government bureaucracy. A higher score indicates a more effective bureaucracy.	Waseem Mina, 2002 (Data originally obtained from the academic version of the International Country Risk Guide (ICRG) published by the Political Risk Group (PRS))
Risk of Repudiation	An index on a scale of 0 to 10 that measures the risk that government will renege on their contracts by modifying the terms due to budget cuts resulting from revenue drops or any political reasons.	Waseem Mina, 2002 (Data originally obtained from the academic version of the International Country Risk Guide (ICRG) published by the Political Risk Group (PRS))
Risk of Expropriation	This is an index on a scale of 0 to 10 that measures the risk of expropriation of private property by government through confiscation or nationalization.	Waseem Mina, 2002 (Data originally obtained from the academic version of the International Country Risk Guide (ICRG) published by the Political Risk Group (PRS))

B) Public Expenditures		
Capital Expenditures	Capital expenditure is spending to acquire fixed capital assets, land, intangible assets, government stocks, and nonmilitary, non-financial assets. This variable is measured as a percentage of total expenditures.	IMF's Government Finance Statistics (GFS), January 2004 CD-ROM, and the World banks' World Development Indicators - 2003 CD-ROM
Health Expenditures	Public health expenditure consists of recurrent and capital spending from government (central and local) budgets, external borrowings and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds.	IMF's Government Finance Statistics (GFS), January 2004 CD-ROM
Education Expenditures	Public expenditure on education consists of public spending on public education plus subsidies to private education at the primary, secondary, and tertiary levels.	IMF's Government Finance Statistics (GFS), January 2004 CD-ROM.
Defense Expenditures	Includes all current and capital expenditures on the armed forces, including peacekeeping forces; defense ministries and other government agencies engaged in defense projects; paramilitary forces, if these are judged to be trained and equipped for military operations; and military space activities.	IMF's Government Finance Statistics (GFS), January 2004 CD-ROM

C) Other economic and Demographic Variables		
GDP per Capita	GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant U.S. dollars	World banks' World Development Indicators - 2003 CD-ROM
GDP per capita growth rate	Annual percentage growth rate of GDP per capita based on constant local currency	World banks' World Development Indicators - 2003 CD-ROM
Investment	Includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings.	World banks' World Development Indicators - 2003 CD-ROM
Export growth	Annual growth rate of exports of goods and services based on constant local currency.	World banks' World Development Indicators - 2003 CD-ROM
Government Consumption	General government final consumption expenditure includes all government current expenditures for purchases of goods and services (including compensation of employees)	World banks' World Development Indicators - 2003 CD-ROM
Schooling	A measure of education attainment in terms of the average years of schooling for the total population over the age of 15 years	Barro, J. Robert and Jong-Wha Lee, 2000
Budget Balance	Overall budget balance is current and capital revenue and official grants received, less total expenditure and lending minus repayments. Data are shown for central government only.	World banks' World Development Indicators - 2003 CD-ROM

Urbanization	The share of the total population living in areas defined as urban in each country.	World banks' World Development Indicators - 2003 CD-ROM
Population under 15 years of age	The percentage of the total population that is in the age group 0 to 14 years.	World banks' World Development Indicators - 2003 CD-ROM
Population between 15 and 65 years of age	Percentage of the total population that is in the age group 15 to 64 years.	World banks' World Development Indicators - 2003 CD-ROM
Population over 65 years of age	Percentage of the total population that is 65 years or older.	World banks' World Development Indicators - 2003 CD-ROM
Population Growth Rate	Annual population growth rate	World banks' World Development Indicators - 2003 CD-ROM
Population Density	Population density is midyear population divided by land area in square kilometers	World banks' World Development Indicators - 2003 CD-ROM

Table E2. Descriptive Statistics for Variables used in Growth Equations

Variable	Obs	Mean	Std. Dev.	Min	Max
Per Capital GDP Growth	540	1.58	3.03	-10.22	11.98
Initial GDP Per Capita (10,000s)	540	0.65	0.94	0.01	4.50
Government Consumption	540	15.49	5.86	3.92	37.98
Private Investment	540	22.35	6.86	5.53	60.14
Growth in Exports	540	5.91	7.41	-28.39	69.81
Years of Schooling	540	5.40	2.80	0.26	12.05
Political freedom Index	540	3.48	1.92	1	7
Rule of Law Index	341	3.56	1.63	0.56	6
Corruption Index	341	3.46	1.48	0	6
Quality of bureaucracy	341	3.44	1.62	0.63	6
Risk of contract repudiation	341	6.85	2.18	2.22	10
Risk of Property expropriation	341	7.47	2.20	1.63	10

Table E3. Correlation Matrix – Growth and Indicators of Governance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)	1											
(2)	0.15	1										
(3)	-0.02	0.44	1									
(4)	0.47	0.07	0.10	1								
(5)	0.49	-0.02	-0.16	0.26	1							
(6)	0.28	0.76	0.37	0.21	0.07	1						
(7)	-0.24	-0.67	-0.34	-0.10	-0.05	-0.70	1					
(8)	0.30	0.75	0.38	0.18	0.09	0.69	-0.64	1				
(9)	0.23	0.74	0.52	0.13	0.05	0.67	-0.63	0.80	1			
(10)	0.27	0.80	0.45	0.15	0.08	0.71	-0.64	0.82	0.84	1		
(11)	0.41	0.68	0.32	0.24	0.12	0.73	-0.62	0.81	0.69	0.77	1	
(12)	0.40	0.57	0.26	0.21	0.15	0.63	-0.57	0.81	0.65	0.70	0.91	1

(1) Per capita GDP growth
(2) Initial GDP per capita
(3) Government Consumption
(4) Private Investment
(5) Export growth
(6) Average years of schooling
(7) Index of Political Freedom
(8) Rule of Law index
(9) Index of corruption
(10) Quality of bureaucracy
(11) Risk of repudiating contracts
(12) Risk of expropriating private property.

Table E4. Descriptive Statistics for Variables in the Expenditure Composition Models

Variable	Obs	Mean	Std. Dev.	Min	Max
Health Expend. Share	1402	0.07	0.05	0.00	0.33
Education Expend. Share	1402	0.12	0.06	0.01	0.30
Defense Expend. Share	1402	0.10	0.08	0.00	0.56
Per Capita GDP (10000s)	1402	0.93	1.02	0.01	4.68
Budget Balance	1402	-3.26	5.79	-35.56	58.71
Urban	1402	59.58	24.75	2.86	100.00
Pop. Under 14 (%)	1402	32.02	9.65	15.70	49.17
Pop between15 & 64 (%)	1402	60.38	5.88	47.03	73.76
Pop 65yrs + (%)	1402	7.52	4.57	1.19	17.90
Pop growth Rate	1402	1.57	1.12	-1.92	6.83
Pop density	1402	231.71	700.29	1.72	6586.89
Political freedom Index	1402	3.01	1.86	1	7
Capital Expend. Share	1356	0.17	0.12	0.01	0.62
Rule of law Index	742	4.04	1.62	0	6
Corruption Index	742	3.90	1.48	0	6

Table E5. Hausman Tests for Endogeneity

Variable	**Test Statistic**	**D.F**	**χ^2 (α = 0.05)**	**Decision**
Investment	26.83	13	22.362	reject H0
School	16.61	13	22.362	Fail to reject H_0
Export growth	222.19	13	22.362	reject H_0
Government consumption	10.69	13	22.362	Fail to reject H_0
Freedom	12.14	13	22.362	Fail to reject H_0

H_0: there is no systematic difference in the coefficients.

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