"ONE HUNDRED PERCENT IN MY POCKET"

TRANSPARENCY, DEBT AND DEVELOPMENT

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Abstract

The dissertation is comprised of three main chapters that study the interplay between institutions, public debt and economic development. The first chapter introduces the dissertation.

The second chapter develops a model of transparency in government to study its impact on economic performance, the provision of education, and democratization. The chapter argues that information acquisition costs, which are linked to transparency of public finances, access to the media and overall levels of education are central to the problem of political corruption (diverting public funds for politicians' private benefit). Corruption, which reduces economic growth and voter welfare, is driven by imperfect information about the actions of politicians, and welfare increases when voters can acquire even limited information. Voter welfare is shown to be a decreasing function of information acquisition costs. Two extensions are developed: the first shows that politicians' incentives to invest in growth-enhancing policies that also reduce informational costs (such as education) may be weak, resulting in lower steady-state growth; the second proposes a mechanism through which transparency (or improved education) may impact the process of democratization and finds that the probability of a dictatorship transitioning to democracy increases with lower informational costs.

The third chapter argues that the concept of "odious debts" is closely linked to a principal-agent problem: debt arguably becomes "odious" when the agents contracting debt—the government—do not use it for the benefit of the principals—the population. A number of authors have called for the cancellation of such odious debts under different frameworks. A political agency model is used to analyze three such frameworks. Ex-ante "loan sanctions" (whereby creditors to sanctioned regimes are denied legal protections against default) are found dominate ex-post loan-by-loan audits. Welfare sometimes decreases in both cases when repressive governments also undertake productive investments; in some cases these governments cease investing but continue to use repression to remain in power. A "responsible lending" approach of verifying the use of loan proceeds may be superior to loan sanctions under some circumstances. An extension of the model suggests that an unintended consequence of odious debt frameworks may be to make it more attractive for creditors to bail out troubled odious regimes.

The fourth chapter investigates the channels through which institutions influence the probability that a country experiences a debt crisis. Two channels are postulated: a direct effect on the willingness to repay, and an indirect effect through institutions' impact on promoting sustained economic growth. I find evidence that improvements in institutions lead to sustained economic growth, which in turn reduces the probability of a debt crisis. The methodology used is based on identifying episodes of economic growth that are sustained over long periods. These "growth episodes" correlate well with long-term growth but are uncorrelated with growth in previous years. This allows a test of whether institutional measures (which are

correlated with contemporaneous growth) contain information that can inform the path of future growth. The findings appear to be particularly strong for a sub-sample of poorer countries, but the results are robust to a number of alternate specifications, most importantly to changes to the parameters in the definition of a growth episode. The results obtained with the growth episode methodology are confirmed by standard panel data analysis. The chapter also considers whether high debt causes both debt distress and slow growth (which would lead to an overestimate of the observed impact of growth on debt distress), but does not find evidence for the latter hypothesis.

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Contents

1

Introduction

On an official visit to London, a Brazilian politician was invited to dinner at the house of a British MP. The MP lived in a lavish mansion with a wonderful view of the Thames. The Brazilian politician was impressed and asked his colleague: "How can you afford this house on such a small salary?" The British politician opened the curtain, pointed to the Thames and asked: "Do you see that bridge?" The Brazilian nodded affirmatively. "Ten percent, in my pocket" said the Briton.

Six months later, the British MP came to Brazil and was invited to the house of his counterpart. The MP was impressed: the house was a villa located in an expansive estate by one of Brasilia's artificial lakes. The British MP asked his colleague: "I know the salaries of Brazilian politicians are less than ours in the UK. How can you afford this?" The Brazilian politician opened a curtain, pointed to the lake, and asked "Do you see that bridge?" The British MP is puzzled. "No." "Well," the Brazilian replies, "one hundred percent, in my pocket."

As told by a taxi driver in São Paulo

There is widespread agreement that "good institutions" are critical for long-term

development and economic growth. Many (and perhaps most) institutions relevant to development can be traced back to functions of the state, including for example the enforcement of property rights, the maintenance of macroeconomic stability, the design and implementation of appropriate regulations, and the provision of public goods such as infrastructure and education. Non-state institutions such as the media, civil society, or business associations are also important, especially for their informational role. However, in the case of institutions which play an enforcement role—such as those responsible for maintaining the rule of law or implementing appropriate regulations—the presence of non-state institutions is generally a sign of state failure (consider the mafia or similar organizations). Moreover, while public goods such as education and infrastructure can be privately provided, the large scale and/or low profitability of such investments generally require government intervention. The focus of the thesis is therefore on the efficiency of government institutions in promoting economic development.

At the heart of the problem of the role of states in promoting economic growth and development is the fact that they are run by individual actors who pursue their own interests, as opposed to benevolent Leviathans only concerned about maximizing the population's welfare. The themes explored in my dissertation ultimately relate to the agency problem between the individuals (agents) that make up the government and the populations that those agents are supposed to serve. The literature on institutions and economic growth sometimes claims that good institutions are accidents of history—the product of patterns of Western colonization, which derive, arguably, from geography. While there is likely to be a large dose of truth to the dependence of

institutions (and development) on geography or history, institutions would be expected to evolve through policy changes to the extent that they alter the agency relationship between government officials and the population. The thesis intends to investigate one aspect of the question of how countries acquire well functioning governments and "good institutions" by analyzing the factors that affect this agency relationship and empirically testing whether changes in institutions indeed lead to higher economic growth.

I focus on the question of why states, and the politicians that run those states, choose policies (and related institutions) of varying levels of efficiency. Within that question, in two of the papers I consider a narrow definition of efficiency: what makes some states convert tax revenues into productive public goods while others divert revenues for the private benefit of politicians? A key argument is that transparency (as defined by an improved ability of the population to observe government actions through transparent budgets, an active media, and education to process the information), reduces the cost of information acquisition and creates incentives for politicians to act in the public interest (which in this framework implies lower corruption and is ultimately equated with promoting economic growth).

This argument is explored directly in Chapter 2, where I construct a theoretical model that maps the cost of information about the actions of politicians to the population's ability to control what politicians do (and how much corruption must be tolerated). Since I am particularly interested in the context of development, I look at incentives in both at democratic and non-democratic regimes and consider other extensions relevant to developing countries. Chapter 3 considers how proposals for

the cancellation of so-called "odious" or "illegitimate" debts affect the agency relationship between government agents and the population, and whether they can improve institutions and reduce corruption and oppression. Although in certain cases an "odious debt" framework may improve the welfare of the population by reducing "repression rents" (higher corruption must be tolerated when the government has a credible threat to resort to repression), the impact of the policy is limited and potential unintended consequences to the government's incentives to invest may outweigh the benefits. The fourth and final chapter looks at institutions and growth from a broader perspective to ask whether there is evidence that measurable changes in institutions lead to improved growth prospects, finding in the affirmative. The chapter returns to considerations about public debt by analyzing whether it affects or is affected by sustained economic growth, arguing for the latter. A secondary argument of the thesis, therefore, is that in the context of economic growth, debt issues are secondary to building institutions that promote government transparency.

Electoral Control with Costly Information Acquisition: Applications to the Political Economy of Development

This chapter uses a political agency model to analyze role of transparency in the delivery of public goods. "Transparency" is modeled as the inverse of the cost incurred by voters to monitor the actions of politicians. The main result of the model is that voter welfare increases monotonically, and opportunities for accumulating rents decrease, with increased transparency. Two applications are then considered. First, the chapter argues that voters' education is a source of transparency in the sense of the

model: more educated voters face a lower cost of monitoring government actions. Under that interpretation, the model also suggests that politicians may not have appropriate incentives for providing optimal levels of education since it reduces their private benefits, which may provide one explanation for the joint persistence of low levels of political and economic development. The second application links democratization and the determinants of transparency in government—including education. The model demonstrates that the probability of democratization is a function of the transparency of the (future) democratic regime; when democratization would lead to a poorly functioning democracy, the population may rationally choose to remain under a dictatorship.

The theoretical model is an extension of Ferejohn's (1986) and Persson, Roland and Tabellini's (1997) political agency models. Ferejohn analyzed the relationship between voters and politicians in a principal-agent framework, noting that the key difference between politicians and firm managers was the lack (or at least the absence of examples) of outcome-contingent contracts; voters are limited to firing or keeping politicians. The model developed in this chapter adds a critical element to Ferejohn's model: voters may learn about the actions of politicians, but this requires effort (a cost) that is proportional to the level of transparency in government. I show that the model yields an expected negative relationship between the cost of information acquisition (interpreted as the degree of transparency of the government's actions) and voter welfare. Conversely, corruption is lower as informational costs decline.

The chapter then proceeds to analyze possible concrete interpretations for transparency in light of the model. The quality of budget institutions, the media and,

critically, voter's education are argued to potentially contribute to increased transparency of government activities. The model thus provides a second channel—beyond the traditional one of human capital accumulation—for education to promote economic development.

The first extension then considers the fact that education is produced by the government, but also affects the government's ability to collect rents. Politicians must trade off the higher growth generated by investments in education with lower rents, and under appropriate conditions under-investment in education emerges. In this model, if voters could sell options of future income streams to politicians, they would be willing to give up current rents to adopt the efficient policy. However, because a new government would be responsible for paying out these options, and would have no credible commitment to do so, they would be worthless.

I then consider a modification of the model to non-democratic settings in order to study an aspect of transitions to democracy and incentives of politicians under alternative regimes. I show that incentives for democratization depend on how much control voters will have over the politician when the country becomes democratic. The welfare of the population under authoritarian regimes is always lower than under democracy (since, at a first approximation, dictators are not accountable, whereas democratic governments are), but dictators can extract higher rents and face greater stability when the alternative to dictatorship is a poorly-functioning democracy where lack of transparency precludes voters from adequately controlling politicians.

The model may also help reconcile the views of Seymour Lipset and Samuel Huntington on whether education contributes to political development (as argued by

Lipset) or to instability (as Huntington argues). The model suggests that as the average level of education increases, the probability of dictatorships being overthrown increases, thus increasing political instability. On the other hand, education also increases the probability that democracies succeed by providing a basis for the accountability of governments.

Odious Debt as a Principal-Agent Problem

This chapter takes the agency model of politics in a different direction to study the potential consequences of implementing legal frameworks for addressing so-called "odious" or "illegitimate" debts. Civil society organizations have stepped up calls for the cancellation of debts which, according to Sack's classic definition, were contracted without the consent of the population and not for their benefit. I argue in the chapter that "odious debt" is a result of the political agency problem discussed in Chapter 2—namely, it is debt where the proceeds were used for private benefit rather than on behalf of the population that must ultimately bear the burden of repayment. I therefore proceed to analyze the implications of the proposed frameworks for dealing with such odious debt on the political agency problem and, consequently, on the welfare of the population.

In principle, debt is contracted by governments on behalf of the population for the purpose of providing public goods (in a broad sense, such as public investments or consumption smoothing, for example). The concept of "odious debts" is therefore closely related to a principal-agent problem whereby the agents contracting debt—the

government—do not use it for the benefit of the principals—the population—who are ultimately responsible for repaying it.

A number of civil society organizations have called for the cancellation of such odious debts, arguing that creditors should bear responsibility for aligning the interests of governments and their populations. These advocates suggest that governments would have better incentives to use debt for the benefit of their populations if creditors restrict loans to certain types of governments, or if creditors can ensure that borrowers use loan proceeds appropriately. Lenders who fail to abide by these norms would generally lose the right to enforce their claim through the court system. A number of specific proposals have been put forward to implement this proposal. Chief among them are the undertaking of debt audits, and repudiating those debts found to be odious (the "ex-post" approach); the imposition of "loan sanctions" whereby loans to regimes declared odious would not be enforced; and "due diligence" whereby creditors would need to prove that loan proceeds are adequately used to ensure that claims are enforceable.

The goal of this chapter is to analyze the implications of these policy proposals using a game-theoretical framework that explicitly models the principal-agent problem between governments and populations. Although an extensive literature has debated the existence of an odious debt doctrine in international law, proposed alternative formulations for a new or expanded framework for the cancellation of odious debts, or discussed alternatives for its implementation, few studies have considered the problem from the point of view of economic theory. Those that have (Kremer and Jayachandran 2002, Jayachandran and Kremer 2006, Choi and Posner 2007), do not

explicitly analyze the impact of an odious debt framework on the political agency problem ultimately at the heart of the debate. In other words, does implementing an odious debt framework indeed help align the interests of governments and populations, thereby increasing the population's welfare?

The model is a highly simplified version of Ferejohn (1986) and Persson, Roland and Tabellini (1997). As in those papers, the relationship between governments and their population is modeled as a principal-agent problem where the primary incentives provided to government executives are the possibility that they can be replaced. The model is modified to include two features relevant to the odious debt debate: first, governments finance their activities partly by borrowing from foreign creditors; and second, governments may seek to remain in power by providing public goods to the population, or by spending resources on repression. Therefore, governments may be replaced by elections in a democratic environment, or otherwise through an overthrow of the current leadership.

The precise nature of the mechanisms available to creditors of sovereign nations to enforce their claims, as well as the empirical evidence for the effectiveness of different mechanisms, has been the subject of an extensive literature that is reviewed in Dömeland, Gil Sander and Primo Braga (2009). Given that the main focus of the chapter is to understand the impact of an odious debt framework on the incentives of governments, I simply assume that an exogenous punishment is available costlessly to creditors, thus generating a maximum loan amount that can be supported in equilibrium. I then make the best-case assumption for the implementation of an odious debt framework, namely that holders of debts that are ex-ante or ex-post

declared odious cannot avail themselves of this punishment. In practice (and as argued in Dömeland, Gil Sander and Primo Braga 2009), no odious debt framework is likely to completely remove the costs that repudiating countries would incur, even if the repudiation has full legal backing.

The baseline model highlights the trade-offs between the willingness of governments to undertake public investments (and thus to forego repression), and both implicit political stability and the returns on public investments. I derive from the baseline model a critical value of w, the exogenous ego-rent of the government, at which politicians are indifferent between using repression or entering electoral competition, and γ, the level of rents that voters must accept to ensure that public investment is incentive compatible. One interesting result is the effect of a "threat of repression" on w: governments sufficiently close to the critical value for w can extract higher rents by implicitly threatening to switch to repression. Reflecting the fact that governments, regardless of their types, seem to repay their debts under normal circumstances, in the baseline all regimes pay similar interest rates, but populations under odious regimes are worse off.

Under appropriate conditions, a "due diligence" framework increases welfare for populations under odious regimes, but benefits are limited by the fact that governments may divert domestic budget resources for private consumption or repression. Increased borrowing costs of non-odious regimes are offset by a reduction in the "threat of repression" effect.

The welfare impact of the "loan sanctions" framework on the population living under odious regimes is also ambiguous due to the diversion of resources from the

domestic budget towards repression. Two cases are possible: governments find it more advantageous to give up repression and be eligible for loans, improving welfare, or budget resources are diverted, lowering investment and welfare.

The "ex-post" regime increases borrowing costs of all regimes, and its effects on welfare depend on how correlated public signals of "odiousness" are with actual use of repression. When uncertainty about future "odiousness" is high, the increased costs of delivering public goods make repression relatively more attractive to otherwise non-odious regimes.

An extension is considered for the case where the cost of repression is randomly distributed. Under the ex-ante odious debt framework, lenders may offer unenforceable amounts (that is, amounts above what would be justified by the exogenous punishment) to repressive regimes to keep them in power and avoid complete default.

The chapter concludes by cautioning against easy policy conclusions—the results of the model are mostly ambiguous, primarily due to the possibility of diversion of domestic resources towards repression. Moreover, as noted above, the assumption that successor governments would not face a punishment under an odious debt framework is admittedly a strong one. Framing the problem as one of political agency does, however, highlight the importance of promoting effective expenditure tracking mechanisms and budget transparency as a means of ensuring that not only the proceeds of loans, but all public resources, are used in the interest of the population rather than for the private gain of politicians in government.

Debt, Institutional Change, and Economic Growth

The fourth chapter is an empirical analysis around the main themes of the dissertation: government institutions, public debt and economic growth. It provides empirical evidence that improvements in the quality of institutions and policies may play a role in promoting sustained economic growth. I show that changes in policies and institutions (as measured by the World Bank's Country Policy and Institutional Assessment—CPIA—index) predict (in the sense of findings of significant coefficients in probit analysis) the onset of episodes of economic growth that is sustained over a period of time. The probit results are confirmed by a system-Generalized Method of Moments (GMM) approach. The link is strongest in the poorer countries: a country with per-capita income of US$500 in 1977 would increase its probability of sustaining 4-percent growth for over 5 years by 14 percentage points with a one point improvement in its CPIA index. The chapter is also related to the literature on institutions and debt sustainability, and shows that policies and institutions affect debt sustainability both directly, but also indirectly through the growth channel: the probability of a country falling into a debt crisis is lower when it is experiencing a sustained growth episode.

The goal of the chapter is to investigate the links between debt, economic growth and policies and institutions. Kraay and Nehru (2006) offer evidence that economic policies and institutions—as measured by the World Bank's CPIA—are robust predictors of debt crises. Meanwhile, the theoretical results of Chapter 2 in this dissertation, as well as substantial empirical and theoretical literature, argue that policies and institutions have a causal role in promoting long-term economic growth.

Countries that experience growth episodes would be expected to experience fewer episodes of debt distress, since evidence suggests that countries default during times of low growth (Tomz 2007, Levy-Yeyati 2008). My goal here is to link these two literatures by investigating the possibility that institutions affect debt sustainability not only directly but also through their effect in long-term economic growth.

I first confirm the hypothesis that a country experiencing sustained economic growth faces a lower probability of debt distress, and then that improvements in policies and institutions, as measured by the changes in the CPIA, are robust predictors of sustained economic growth. These findings underlie the argument of the chapter that there are two important channels through which institutions affect debt sustainability: independently, and through their role in promoting economic growth.

Debt, growth and institutions are related in multiple directions, and therefore I pay particular attention to problems of reverse causation. For example, is the correlation between slow growth and debt distress due to the fact that high debt leads both to debt crises and low growth—through a debt overhang effect (Krugman 1988), or by hindering the ability of governments to make investments with potential growth externalities (such as education or infrastructure)? I do not find evidence to support those hypotheses, but rather confirm that it is more likely that debt burdens are influenced by growth.

The episodic approach to studying sustained economic growth is meant to address concerns of endogeneity and reverse causation in the link between institutions and growth. I identify sustained and un-sustained growth episodes that are very similar at the outset, particularly as it relates to recent growth history. This precludes

identification if the independent variables (such as the CPIA) are simply growth correlates (a common and justified concern with institutional variables). By using probit techniques, I show that changes in the quality of institutions predict the onset of growth episodes.

I further substantiate the findings of the chapter by applying panel data techniques to all available data, including system GMM that explicitly addresses endogeneity in explanatory variables. Regardless of the approach used, I find that improvements in institutions are generally significant predictors of future growth. This provides some evidence that the policies and institutions measured by the CPIA have a causal impact on long-term growth.

Two main conclusions emerge from this chapter. The first is a refinement of Kraay and Nehru (2006): policies and institutions seem to influence the probability of debt distress directly, but they are also important through their role in promoting sustained economic growth. On a theoretical level, one could go back to the model in the "Odious Debt" chapter and think of the two channels as two types of constraints that affect the probability a country will default: the former arises from strategic interactions (incentive-compatibility constraints that are relaxed when institutions are better), while the latter represents resource (or budget) constraints (which are relaxed when growth is high). This framework parallels the concepts of "ability" and "willingness" to pay used in financial markets to assess how risky a country's debt securities are: a country's "ability to pay" refers to resource constraints, while its "willingness to pay" is related to the outcome of strategic interactions.

The second conclusion is a refinement of existing empirical analysis on the relationship between growth and institutions. So far, that literature has focused only on static measures of institutions, whereas I am able to demonstrate that changes in institutions and policies are possible and have a positive growth effect. This is an important distinction, since it shows that even (relatively) small improvements in policies and institutions (of the type likely to be captured by the changes in CPIA scores) can actually have important positive effects in terms of economic growth.

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2

Electoral Control with Costly Information Acquisition: Applications to the Political Economy of Development

It has become widely accepted that "institutions" are key to economic development, but the precise nature of institutions, as well as the dynamics of their emergence and change, remains an open subject. One concrete institution that is clearly essential to economic development is the delivery of public goods and services. Some governments efficiently channel tax revenues into education, security, enforcement of property rights, adequate regulation and infrastructure. In other cases, officials divert large sums of public money for private benefit. The latter governments are in line with what Kohli (2004) terms "neo-patrimonial" states, which are characterized by "a core tendency in many of them for those holding public offices to treat public resources as personal patrimony." He goes on to note that "state-led development under the auspices of neo-patrimonial states has often led to development disasters, mainly because both public goals and capacities to pursue specific tasks in these settings have been repeatedly undermined by personal and sectional interests."

Why do some states become "neo-patrimonial" and experience development disasters while others become "developmental" (to use Evans' 1995 terminology for states that are effective in promoting economic development through the effective

delivery of public goods)? And why do populations allow "neo patrimonial" states to persist? Although path dependence from colonial institutions, the channel identified by Kohli and Acemoglu, Robinson and Johnson (2001)[1], is undoubtedly relevant in answering the above questions, I am interested in better understanding the mechanism through which institutions are maintained and how they might evolve.

While both the incentives and the capacity of the public sector are important determinants of a state's effectiveness in the delivery of public goods and services, I focus here on the incentives of government executives—namely, the consequences of the conflict between public goals and personal interests of politicians ultimately in charge of public administration. Such conflict of interests can be usefully characterized as a principal-agent problem. One can imagine voters as shareholders of a firm, and office-holders as the firm's managers. There is one key difference, however, between office-holders and managers: namely, state-contingent monetary transfers are not available in a political setting. Voters are usually limited to re-electing or firing incumbent politicians. Nevertheless, in both cases the agents have better information than the principals: each voter can only observe directly a very small fraction of government output or activities. For the most part, voters learn about the actions of their public officials through the media, other agencies and word-of-mouth—all of which carry a significant amount of noise.

As far as "capacity" is concerned, distributional factors (such as ethnic fractionalization) are likely to play a major role. The incentives for politicians to build the state's capacity are dampened by fractionalization (if the probability of being overthrown is high, there are few incentives for building an effective state that can be

appropriated by opponents), but constraints are also more likely to be binding (the opportunity cost of building capacity are the short-term measures needed to hold on to power). However, the model presented in the current chapter provides another, perhaps less obvious perspective: in certain cases, building capacity (through improved education, for example) conflicts with the private interest of politicians.

The main goal of this chapter is to develop a formal model of the information asymmetry between incumbent politicians and voters and to analyze how access to (costly) information on the part of voters affects the incentives faced by incumbents and, consequently, their behavior towards public monies. I show that corruption—defined as the portion of public resources appropriated for the private benefit of government officials—decreases when voters can acquire even limited information about the behavior of politicians, and that corruption is an increasing function of the cost of acquiring information about politicians' behavior. I conclude that the persistence of corrupt "neo-patrimonial" states is driven, at least in part, by how costly it is for voters to acquire information about the behavior of incumbents.

I argue that education, along with the quality and independence of the media and other informational agencies (such as budget agencies and their auditors) are the main determinants of the cost of acquiring information about politicians' actions. Education in the form of literacy allows voters to use the print media to acquire information, while education in a broader sense allows voters to understand the consequences of economic policy and broaden their understanding of what is feasible (for example, the understanding that high corruption rents are not required everywhere for politicians to provide public services).

While I primarily consider the incentives of politicians in a democratic setting where voters choose whether to re-elect politicians, I extend the model to consider the case of authoritarian regimes (generically referred to here as "dictatorships") and analyze a possible mechanism through which lower costs of information acquisition (in the form of education and the media) increase the probability that a dictatorship becomes a democracy. The model developed in the next chapter considers additional implications of non-democratic settings to agency models of politics.

This chapter is organized as follows: the first section presents three models of political control that will be compared. I first motivate and lay out the basic set-up of the model. I then develop a model based on Ferejohn (1986) and Persson, Roland, and Tabellini (1997) to analyze political corruption when no information acquisition is possible. Next, I consider a model of perfect information as a benchmark, and then develop the main extension incorporating costly information acquisition. The second section considers an extension to study the case of authoritarian regimes and democratization. The third section briefly relates the present chapter to existing literature and discusses empirical results that motivate my analysis, while the fourth section concludes.

The Model

Motivation and Set-up

Because the problem that I am interested in (namely, the efficiency with which government provides public goods overall) has no distributive aspects among voters, it is appropriate to work with a representative voter framework, where a single voter

represents homogeneous preferences across a large electorate. I consider an economy where government is the only productive sector: it takes an exogenous budget and invests in the production of public goods, which have a stochastic return. The government is modeled as an office-holder (the incumbent), who is in charge of actually making the investment, and there is a large number of identical challengers who could be placed in office in case the voter decides to fire the incumbent. A benevolent government would always just invest the entire budget on public goods, thus maximizing voter welfare. Politicians are corruptible, however, and maximize their own utility when deciding how much of the government's budget to invest and how much to appropriate as graft. Since all politicians are equally corruptible, this is strictly a model of moral hazard.

The government runs a balanced budget and has a budget constraint $b = g_t + r_t$, where b is the (for now, exogenous and constant) government budget, g_t the value of investment in public goods and r_t are rents captured by incumbents; t are time subscripts.

The government undertakes investment in public goods that return $(1 + \theta_t)g_t$, where θ_t is an independent and identically-distributed (*iid*) random variable distributed according to a differentiable distribution F with support in $[0, m]$.

For simplicity, I assume voters and politicians are risk neutral and period preferences are given by:

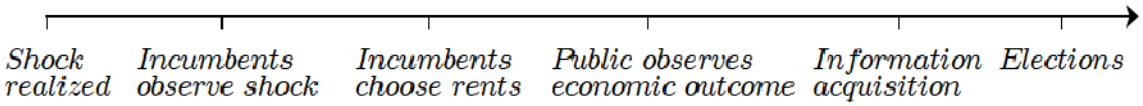
$$\text{politicians:} \quad v(r_t, \theta_t) = r_t + w \tag{2.1}$$

$$\text{voters :} \quad u(r_t, \theta_t) = g_t(1 + \theta_t) = (1 - r_t)(1 + \theta_t) \tag{2.2}$$

where w are exogenous political wages or "ego" rents.

The timing of the game (illustrated in Figure 2.1 below) is as follows: first the economy-wide shock θ_t (the productivity of public investments) is realized. This shock could be technological, or can also be interpreted as a shock that affects the government's budget (a shock to commodity prices, for example). Incumbents observe the shock, but voters do not. Given the observed shock, incumbents choose the level of rents (and thus the proportion of the budget that will actually be invested in public goods). The public then observes the outcome of the investment in public goods $(1 + \theta_t)g_t$, but cannot observe whether a bad outcome is the product of a bad shock (low θ_t) or corruption on the part of politicians (low g_t). At this point, voters may pay an exogenous cost k to learn the value of the shock. Finally, elections take place and the game is repeated indefinitely. Future payoffs are discounted at a rate $\delta \in (0,1)$.

Figure 2.1: Timing of the Model



I assume a "no recall" rule, according to which once a politician is fired, he may not be re-elected and receives utility zero forever. As demonstrated by Ferejohn (1986), the "no recall" case provides the greatest control (as opposed to the case where fired incumbents may return to the office), and therefore I expect similar results in this model if I included positive probability of re-election following dismissal.

I conjecture that voters use a cut-off voting rule. Namely, voters re-elect incumbents if they deliver utility $u_t \geq u$, where u is the cut-off utility level endogenously determined according to the model used. If $u_t < u$ voters fire the incumbent when information acquisition is not possible or they acquire information whenever possible. For simplicity I consider only stationary strategies in this game.

I begin my analysis by developing two benchmarks, the case where information acquisition is not possible, and the case where information may be acquired costlessly.

Equilibrium without Information Acquisition

The case where information acquisition is not possible is a modification of Ferejohn's (1986) model similar to that in Persson and Tabellini (2000). The incumbent's choice is between offering $u_t \geq u$ and being re-elected, or appropriating the entire budget and foregoing re-election. If the incumbent chooses re-election, it is clearly optimal to offer voters only the minimum utility required for re-election, namely u. Therefore, the choice of incumbents in terms of rents can be summarized as:

$$r_t = \begin{cases} b - \frac{u}{1+\theta_t} \\ b \end{cases} \tag{2.3}$$

Replacing (2.3) into (2.1) yields the utility of the incumbent as a function of u, θ_t, δ, and V^I (the continuation value of the incumbent in case of re-election).

$$v(r_t, \theta_t) = \begin{cases} b - \frac{u}{1+\theta_t} + \delta V^I \\ b \end{cases} + w \tag{2.4}$$

I assume that incumbents may not pay to stay in office, and therefore restrict my attention to $r_t \geq 0$. In this case, this implies that $r_t = b - \frac{u}{1+\theta_t}$ only if $1 + \theta_t \geq \frac{u}{b}$.

Note that there will be two restrictions on the incumbent's choice of rents: first, as just noted, rents must be non-negative; second, it must be optimal for the politician to choose re-election (discussed next). One of those two restrictions will be redundant, but we do not know a priori which one.

Because I seek an equilibrium where the incumbent chooses re-election at least some of the time, the second restriction is an incentive compatibility condition required for the incumbent to choose re-election: $b - \frac{u}{1+\theta_t} + \delta V^I \geq b$ or

$$1 + \theta_t \geq \frac{u}{\delta V^I} \text{ if } 1 + \theta_t \geq \frac{u}{b} \tag{2.5}$$

Let $a \equiv \min\{\delta V^I, b\}$ then (2.5) is summarized by $1 + \theta_t \geq \frac{u}{a}$. Therefore, the government's choice depends on the realization of the shock θ_t (better shocks make choosing re-election—and limited corruption—more likely) and the cut-off level u (higher cut-off points make complete expropriation more likely).

The voter's expected (period) utility obtained by replacing (2.3) into (2.2) and multiplying by the appropriate probability is:

$$\begin{aligned} \mathrm{E}u(r_t, \theta_t) &= u\Pr\left(\theta_t \geq \frac{u}{a} - 1\right) \\ &= u\left[1 - F\left(\frac{u}{a} - 1\right)\right] \end{aligned} \tag{2.6}$$

Equation (2.6) shows the trade-off voters face between the level of the utility/income realizations (increasing in u) and the frequency of those realizations (decreasing in u).

Proposition 1. *The optimal cut-off point when information acquisition is precluded is given by*

$$u = \frac{1-F\left(\frac{u}{a}-1\right)}{f\left(\frac{u}{a}-1\right)}a. \tag{2.7}$$

Proof. Since (2.6) already includes the incentive compatibility constraint, u is derived by unconstrained maximization of (2.6) with respect to u, which yields $1 - F\left(\frac{u}{a}-1\right) - \frac{u}{a}f\left(\frac{u}{a}-1\right) = 0$. Recall that $a \equiv \min\{\delta V^I, b\}$; I later consider the value of a.

The continuation value V^I of incumbents is given by

$$V^I = \int_0^{\frac{u}{a}-1}(w+b)dF(\theta_t) + \int_{\frac{u}{a}-1}^{m}\left(w+b-\frac{u}{1+\theta_t}+\delta V^I\right)dF(\theta_t).$$

The first term represents the welfare of the politician when the shock is "bad" and the politician takes as much of the budget as she can and leaves, while the second term represents the welfare of the politician when the shock is "good" and she chooses reelection. The continuation value simplifies to:

$$V^I = \frac{w+b-u\int_{\frac{u}{a}-1}^{m}\left(\frac{1}{1+\theta_t}\right)dF(\theta_t)}{1-\delta\left[1-F\left(\frac{u}{a}-1\right)\right]} \tag{2.8}$$

I now turn to a. Given the solution for V^I above, it is difficult to analytically describe a without making assumptions about the distribution function F. Therefore, assume now that $F(\theta_t)$ is distributed according to the uniform distribution with support [0,1]. In this case, $u = a$ and (2.8) becomes

$$V^I = \frac{w+b-a\log 2}{1-\delta}$$

Proposition 2. *Under the assumption of a uniform distribution on* [0,1] *for* $F(\theta_t)$ *and* $w \geq \frac{1-\delta}{\delta} b$, $u = \mathrm{E}u_t = b$.

Proof. Imposing the uniform distribution to (2.7) gives $u = a$. Replacing this into (2.6) gives $Eu_t = a$. First suppose $\delta V^I \geq b$ so that $a = b$. This implies that $\delta V^I = \frac{\delta}{1-\delta}[w + b(1 - \log 2)]$. In order to be valid, the case with $a = b$ must have $\delta V^I \geq b$, which is true for $w \geq \left(\frac{1}{\delta} + \log 2 - 2\right) b$. As a result, one possible equilibrium is $u = b$ and $\mathrm{E}u_t = b$. Next suppose that $a = \delta V^I$. This case requires $\delta V^I \leq b$, which is true for $w \leq \left(\frac{1}{\delta} + \log 2 - 2\right) b$. Under the assumption that $w \geq \frac{1-\delta}{\delta} b$, $w \geq \left(\frac{1}{\delta} + \log 2 - 2\right) b$ is true for any δ, so that only the first case is feasible and therefore $a = b$ and $Eu_t = b$.

I discuss below the reason for assuming that $w \geq \left(\frac{1-\delta}{\delta}\right) b$. As will be shown, this is the requirement for an equilibrium where politicians wish to stay in office given that voters have perfect information about the shock. I make this assumption to ensure that I can keep w constant across equilibria so that comparisons between the different equilibria are meaningful.

When voters have no information (and under the assumption of uniform shocks) the politician captures the entire surplus of the public investment and simply returns the budget to the voters. One counterfactual feature of this equilibrium is that incumbents are never fired. Since $a = b$ in equilibrium, the incentive compatibility condition (2.5) always holds. Voters in this case are indifferent between having a government or not (since they get no returns from investment in public goods), but I assume that they resolve their indifference by choosing to have a government.

Equilibrium with Costless Information Acquisition

Now I consider the other extreme case where information is costless. This is the case where voters have maximum control over the actions of politicians. I modify the general framework of the model as follows: voters set a cut-off utility level u and if the politician delivers $u_t \leq u$ the voters learn the value of the shock and fire the politician if $r_t > 0$. When information is costless, the representative voter sets $u = (1 + m)b$, which implies that voters always learn the value of the shock and fire the politician unless $r_t = 0$ every period.

The voter's expected utility in this case is given by

$$\mathrm{E}u = (1 + \mathrm{E}[\theta_t])b \tag{2.9}$$

In this case $V^I = \frac{w}{1-\delta}$, and therefore incentive compatibility requires $w \geq \frac{1-\delta}{\delta} b$. Alternatively, w can be thought of as the minimum amount of rents required by politicians to stay in office instead of capturing the entire budget.

Proposition 3 *Under the assumption that $F(\theta_t)$ is uniformly distributed on* [0,1] *and $w \geq \frac{1-\delta}{\delta} b$, voter utility in the equilibrium with costless information acquisition is greater than that under no information acquisition.*

Proof. This is trivial from (2.9) and Proposition 2: $\mathrm{E}u_t(\text{information}) = \frac{3}{2} b > \mathrm{E}u_t(\text{no information}) = b$.

Proposition 3 simply points out the intuitive (if obvious) result that more information on the part of voters leads to less corruption (in fact, no corruption) and increases voter welfare.

Equilibrium with Costly Information Acquisition

Now consider the case where information is available but its acquisition entails the payment of an exogenous and time-invariant cost $k > 0$. I assume, as in the equilibrium with costless information acquisition, that voters set a cut-off utility level u and if the politician delivers $u_t \leq u$ the voters pay k to learn the value of the shock and fire the politician if $r_t > 0$.

If $\delta V^I < b$, the incumbent will always appropriate the entire budget and forego re-election. In order to identify an equilibrium where the politician always chooses to be re-elected, the following incentive-compatibility condition is required:

$$\delta V^I \geq b. \tag{2.10}$$

In this case, the incumbent's choices are similar to those described above and given by:

$$r_t = \begin{cases} b - \frac{u}{1+\theta_t} \text{ if } 1 + \theta_t \geq \frac{u}{b} \\ 0 \text{ otherwise} \end{cases} \quad \Longrightarrow \quad v(r_t, \theta_t) = \begin{cases} b - \frac{u}{1+\theta_t} + \delta V^I + w \\ \delta V^I \end{cases} \tag{2.11}$$

The fact that incumbents always seek re-election, embodied in (2.10) leads to the undesirable (and counter-intuitive) implication that voters will incur a cost to audit the incumbent although they know they will find the politician set $r_t = 0$. This equilibrium may be sustained by assuming that if voters fail to audit incumbents in any period politicians revert to a "grim trigger" strategy of appropriating the entire budget every period. The voter's (weakly) optimal response is to fire the incumbent every period, and since both actions are optimal responses, this is a Nash equilibrium that may be used to enforce auditing in the equilibrium I am currently analyzing.[2]

The voter's expected (period) utility is given by:

$$\mathrm{E}u(r_t, \theta_t) = u\left[1 - F\left(\frac{u}{b} - 1\right)\right] + [(1 + \theta^m)b - k]F\left(\frac{u}{b} - 1\right) \tag{2.12}$$

where $\theta^m = \int_0^{\frac{u}{b}-1} \frac{\theta}{\frac{u}{b}-1} dF(\theta)$ is the expected value of the shock within the interval where the voter audits the incumbent. In this case it will be convenient to assume from the beginning that shocks are uniformly distributed on [0,1].

Proposition 4. *The optimal voting rule when voters may learn the value of the shock θ_t by paying a cost $k > 0$ and assuming shocks are uniformly distributed over (0,1) is given by*

$$u = 2b - k \tag{2.13}$$

Proof. Consider the first-order conditions of the voter maximization problem:

$1 + \left(\frac{\partial \theta^m}{\partial u} b - 1\right) F\left(\frac{u}{b} - 1\right) + \frac{1}{b}\left((1 + \theta^m)b - k - u\right) f\left(\frac{u}{b} - 1\right) = 0$, which implies

$$\frac{1}{f\left(\frac{u}{b}-1\right)} + \left(\frac{\partial \theta^m}{\partial u} b - 1\right) \frac{F\left(\frac{u}{b}-1\right)}{f\left(\frac{u}{b}-1\right)} + (1 + \theta^m) - \frac{k+u}{b} = 0 \tag{2.14}$$

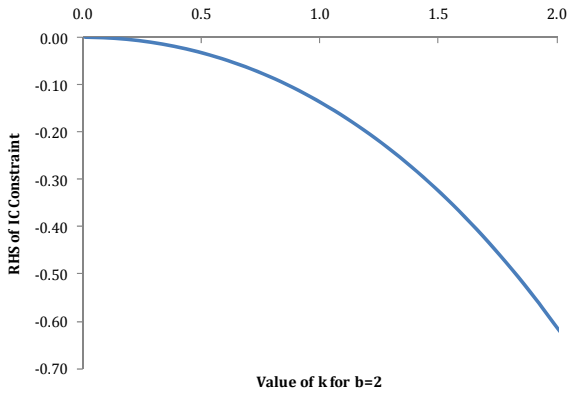
When $F(\theta_t)$ is the uniform distribution, $\theta^m = \frac{1}{2}\frac{u-b}{b}$ and I obtain (2.13) from (2.14).

I now compute the continuation value of the incumbent and confirm that the incentive compatibility constraint is satisfied: $V^I = w + \int_{\frac{u}{b}-1}^{m} \left(b - \frac{u}{1+\theta_t}\right) dF(\theta) + \delta V^I$ or

$$V^I = \left(\frac{w + \left[1 - F\left(\frac{u}{b}-1\right)\right]b - u \int_{\frac{u}{b}-1}^{m} \left(\frac{1}{1+\theta_t}\right) dF(\theta)}{1-\delta}\right) \tag{2.15}$$

When $F(\theta_t)$ is the uniform distribution, (2.15) becomes $V^I = \left(\frac{w+k-(2b-k)\log\frac{2b}{2b-k}}{1-\delta}\right)$. I check the incentive compatibility constraint (2.10): $w \geq \frac{1-\delta}{\delta}b + (2b-k)\log\left(\frac{2b}{2b-k}\right) - k$. Given my ongoing assumption that $w \geq \frac{1-\delta}{\delta}b$, the incentive compatibility condition holds as long as $(2b-k)\log\frac{2b}{2b-k} - k \leq 0$, which, assuming (as seems reasonable) that $b > k$, is true for all $k \in [0, b)$ as shown in Figure 2.2 below.[3]

Figure 2.2: Verifying that Incentive Compatibility is met



Proposition 5. *For all $k \in [0, b)$ voter welfare is higher than the case where information acquisition is not possible. Moreover, voter (expected) utility is a decreasing function of the costs of acquiring information and expected rents are an increasing function of the costs of acquiring information.*

Proof. The voter's expected period utility under this equilibrium is obtained by substituting the value of u in (2.12) and is given by $Eu(r_t, \theta_t) = 2(2b - k) - \frac{(2b-k)^2}{2b} - \frac{b}{2} - \frac{k(2b-k)}{b} + k$, which yields:

$$\mathrm{E}u(r_t, \theta_t) = \frac{1}{2b}k^2 - k + \frac{3}{2}b \tag{2.16}$$

which is $\geq b$ for all $k \leq b$.

The second part of the proposition is immediate from differentiating equation (2.16) with respect to k, which gives $\frac{k}{b} - 1 < 0$ for $k \in [0, b)$.

Expected rents are obtained by integrating equation (2.11) over the range where rents are positive ($\frac{u}{b} - 1 \geq \theta \geq 1$), $\int_{\frac{u}{b}-1}^{1} b - \frac{u}{1+\theta} d\theta = (2b - u) - u \log \frac{2b}{u}$, which for $u = 2b - k$ yields:

$$\mathrm{E}r_t = k - (2b - k) \ln \frac{2b}{2b-k} \tag{2.17}$$

Voter welfare and rents (corruption) are illustrated in Figures 2.3 and 2.4, which show graphically how the current version of the model is a generalization of the two cases considered previously: when information costs are very high ($k \geq b$), voters set $u = b$ and we return to the equilibrium without information acquisition and high corruption; meanwhile, $k = 0$, corresponds to the case where the voter has perfect control of the incumbent and no corruption exists in equilibrium. The main result of the model is to show that utility (and corruption) is a monotonic function of the information cost.

Figure 2.3: Relationship between Information Costs and Voter Utility

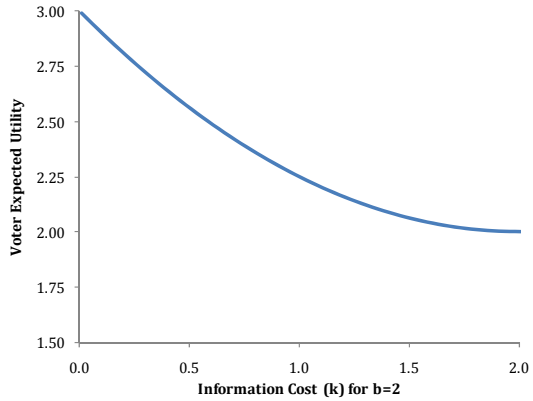
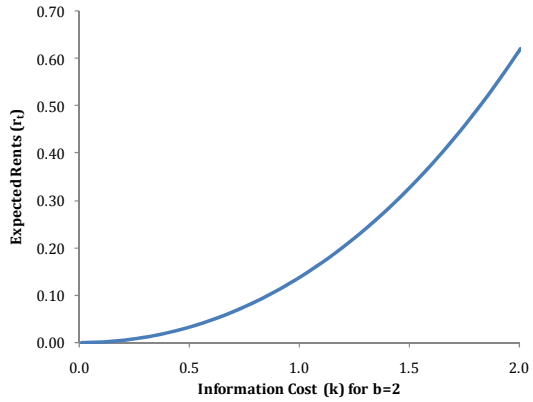


Figure 2.4: Relationship between Informational Costs and Expected Rents



Note that the cost of information determines the cut-off u, and an alternative interpretation of the auditing rule is to think that when utility is under the cut-off voters make an effort to find out what incumbents did; when information is very expensive, only a dismal outcome will warrant such effort. The counter-intuitive aspect of the equilibrium lies more with the fact that politicians are never fired, which is a feature of the model generally than this particular extension whereby auditing always occurs for $u_t < u$.

For completeness, I consider in the Annex whether voters may not be better off by selecting the following rule: if $u_t > u$, audit the politician and otherwise fire her. I show that this rule is sub-optimal for all values of k.

Education and Democratization

Incentives for Investing in Education

One interpretation for the cost of information acquisition k is to relate it to levels of education. Better educated voters face a lower cost of acquiring information about the actions of politicians, as well as their consequences to their welfare. At a minimum, literate workers gain access to print media, and indeed there is evidence (Dee 2004) that additional schooling increases the frequency of newspaper readership. In addition, more educated voters face a lower cost of producing forecasts of their expected utility based on given public information. Finally, Dee (2004) also presents evidence that more educated voters are more likely to participate in elections, suggesting that their costs of voting are lower for more educated voters.

Education, in turn, is generally produced by the government, at the same time that it affects politicians' ability to collect rents. Politicians must trade off the higher growth generated by investments in education (which may increase rents by making the pie bigger) with lower costs of information acquisition (which, as seen above, reduces rents by allowing voters to keep a larger share of the pie). I show below that this trade-off leads governments to under-invest in education under certain conditions. This result is in line Acemoglu (2003)'s "political Coase theorem", which argues that investments that increase the social pie may not be undertaken: agents currently in

power are unwilling to undertake reforms that will undermine their ability to extract future rents since the beneficiaries from reform cannot credibly promise to compensate the elite once the elite is no longer in power.

I begin by modifying the model in the previous section such that $k = \gamma b$, where $\gamma \in \{0,1\}$. Under this formulation, k increases as the budget increases (a reasonable assumption, since a greater budget is likely to be more complex and require proportionally greater monitoring efforts). This implies that expected rents are given by $b\left[\gamma - (2-\gamma)\ln\frac{2}{2-\gamma}\right]$. As expected, rents increase trivially in b, but also in γ (differentiating the expression in brackets with respect to γ gives $ln\frac{2}{2-\gamma}$, which is greater than zero).

Now consider a one-off opportunity for the government to increase the levels of education forever by making an investment in education. This would simultaneously and permanently increase b (for example, through greater human capital accumulation) and lower γ (for example, by increasing newspaper readership). The opportunity is provided through a grant (that is, it does not require that the government has budget for the investment), and is only available immediately after elections. Because this is a one-off opportunity, voters cannot credibly commit to reward the politician if she makes the investment.

Therefore, the politician chooses to undertake the investment if

$$b'\left[\gamma' - (2-\gamma')\ln\frac{2}{2-\gamma'}\right] \geq b\left[\gamma - (2-\gamma)\ln\frac{2}{2-\gamma}\right] \qquad (2.18)$$

where $b' > b$ and $\gamma' < \gamma$. Let x be the growth rate of the budget that can be achieved with the investment. Then $\frac{b'}{b} = 1 + x$.

Proposition 6. *If an investment in education increases the budget b by a rate x and at the same time reduces γ to $\gamma' < \gamma$, the politician only chooses to undertake the investment if $x \geq \frac{\gamma-(2-\gamma)\ln\frac{2}{2-\gamma}}{\gamma'-(2-\gamma')\ln\frac{2}{2-\gamma'}} - 1$, which is monotonically increasing in $\gamma' - \gamma$.*

Proof. The first part is simply 2.18 re-written as a condition on x:

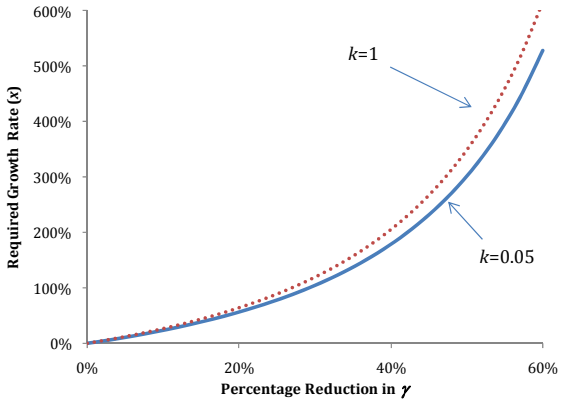
$$x \geq \frac{\gamma-(2-\gamma)\ln\frac{2}{2-\gamma}}{\gamma'-(2-\gamma')\ln\frac{2}{2-\gamma'}} - 1 \qquad (2.19)$$

The right-hand side of (2.19) goes to infinity as $\gamma' \to 0$. As shown above, rents are increasing in γ; the right-hand side of 2.19 is decreasing in γ' by the same logic. It is therefore monotonically decreasing in γ' for a given γ.

When $\gamma - \gamma'$ is large (that is, the growth-enhancing reform also reduces informational costs significantly), the investment in education would not take place unless the growth rate is also very large. Figure 2.5 below illustrates the relationship between the required growth rate and the percentage reduction in γ. The exponential relationship also implies that a reform that has the same proportional effect on the cost of information acquisition (say, reduce it by 10 percent) is more likely to be undertaken (that is, it requires a lower x) in a country where informational costs are lower (see the dotted line in Figure 2.5). Therefore, another implication of the model is that politicians in countries with high existing costs of information acquisition (where economic performance is already weak) are generally more reluctant to undertake

growth-enhancing investments that reduce information costs and their ability to collect rents.

Figure 2.5: Growth Rates Required for Investment given Different Percentage Reductions in γ



A Simple Model of Dictatorship and Democratization

So far I have considered the role of information acquisition in electoral control under a democratic environment. Since my focus is on developing countries, I extend the model to understand the role of the costs of information acquisition under authoritarian environments and the process of democratization.

Now I consider an extension to examine the difference between dictatorships and democracies. I model a dictatorship in the style of Acemoglu and Robinson (2001) as a case where firing the incumbent entails the payment of a cost ω_t, which is an iid random variable independent from θ_t and drawn from a "well-behaved" distribution $F(\omega_t)$, which for simplicity I assume to be uniform with support [1,2]. This cost can be interpreted as the presence of a charismatic leader or other random events that

make solving the collective action problem of organizing a revolution less costly. Note that unlike Acemoglu and Robinson (2001) I cannot assume that the random shocks are related to the business cycle (which in their model changes the opportunity cost of revolution) since I want to isolate the macroeconomic shocks that influence the behavior of the politician from shocks that make revolution less likely; a fuller model would explore the connection between both types of shocks. Both the dictator and the population observe the realization of ω_t simultaneously. If a revolution takes place, the country becomes democratic forever and I revert to the model developed in earlier sections. In this extension we assume $b = 1$ to simplify calculations.

The population overthrows the dictator if the present value of the benefits outweighs the costs. Namely, revolution takes place if $V^{dem} - \omega_t > V^{dic} + u_t$, where V^{dic} is the value of continuing in the dictatorship, and $V^{dem} = \left(\frac{1}{1-\delta}\right)\left(\frac{1}{2}k^2 - k + \frac{3}{2}\right)$ is the value of democracy as calculated earlier; as noted above, the value of democracy is decreasing in k for the relevant range of $k \in [0,1)$.

The dictator's choices of rents are given by

$$r_t = \begin{cases} 1 \text{ if } \omega_t > V^{dem} - V^{dic} \text{ or } \omega_t \leq V^{dem} - V^{dic} - (1+\theta_t) \\ 1 - \left(\frac{V^{dem} - V^{dic} - \omega_t}{1+\theta_t}\right) \text{ otherwise} \end{cases} \tag{2.20}$$

The dictator appropriates the entire budget if the cost of revolution is too high, or if costs are low enough that the dictator cannot prevent a revolution by redistributing current income. Meanwhile, if costs are neither too high nor too low the dictator gives the population just enough income to thwart a revolution and keeps the balance as rents. Thus one can already see that dictatorships will produce worse

economic outcomes than democracies, at least in the narrow sense of the current model that politicians will have weaker incentives to be honest, since not only the voters have no information about the behavior of dictators, but even when they would like to fire them (as they would in the previous model) they may be precluded because of the cost ω_t.

I seek an equilibrium where the dictator chooses to maintain the dictatorship when $\omega_t > V^{dem} - V^{dic} - (1 + \theta_t)$ (that is, the intermediate range of ω_t where voters get positive utility from the dictator). The associated incentive compatibility condition is given by:

$$\delta V^{I,dic} \geq \left(\frac{V^{dem} - V^{dic} - \omega_t}{1+\theta_t}\right) \tag{2.21}$$

where the right-hand side is less than 1.

The voter's expected utility under dictatorship (assuming that all shocks are uniformly distributed) is given by

$$V^{dic} = \delta V^{dic}\left[1 - \left(V^{dem} - V^{dic}\right)\right] + \delta V^{dem}\left(V^{dem} - V^{dic} - \left(1 + E(\theta_t)\right)\right) +$$

$$\left[\left(V^{dem} - V^{dic} - E(\omega_t)\right) + \delta V^{dic}\right]\left[\left(V^{dem} - V^{dic}\right) - \left(V^{dem} - V^{dic} - \left(1 + E(\theta_t)\right)\right)\right] \tag{2.22}$$

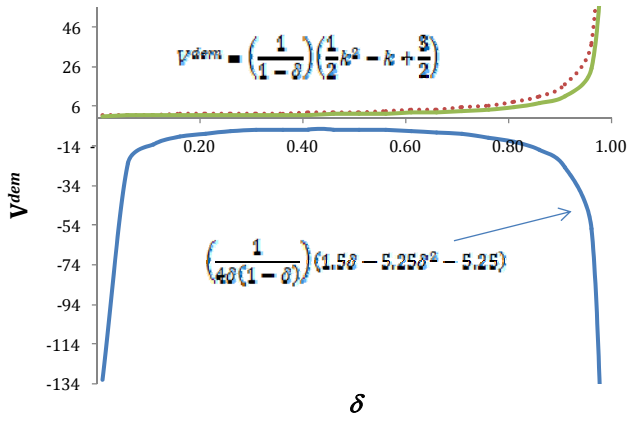
The first term corresponds to the case where the shock is high and revolution is not feasible; the second term corresponds to the case where the shock is low enough that revolution is unavoidable, while the third term corresponds to the intermediate case where a revolution can be thwarted through appropriate transfers. This expression solves to:

$$V^{dic} = 1.25\left(\frac{1-\delta}{\delta}\right) + V^{dem} - \left(\frac{1}{2\delta}\right)\sqrt{6.25\delta^2 - 3.5\delta + 4\delta(1-\delta)V^{dem} + 6.25} \quad (2.23)$$

Proposition 7. *For the appropriate range of* V^{dem} *(k between 0 and 1),* $V^{dem} \in \left\{\left(\frac{1}{1-\delta}\right), \frac{3}{2(1-\delta)}\right\}$, V^{dic} *is increasing in* V^{dem} *and therefore decreasing in* k. *Moreover,* $V^{dem} > V^{dic}$.

Proof. To see the first part of the proposition, consider that $\left(\frac{\partial V^{dic}}{\partial V^{dem}}\right) = 1 - \left(\frac{(1-\delta)}{(6.25\delta^2 - 3.5\delta + 4\delta(1-\delta)V^{dem} + 6.25)^{\left(\frac{1}{2}\right)}}\right) \geq 0$ when $V^{dem} \geq \left(\frac{1}{4\delta(1-\delta)}\right)(1.5\delta - 5.25\delta^2 - 5.25)$. As can be seen in Figure 2.6 below, this is true for any delta when V^{dem} is in the relevant range (the lines above the δ axis correspond to the relevant values of V^{dem} given δ).

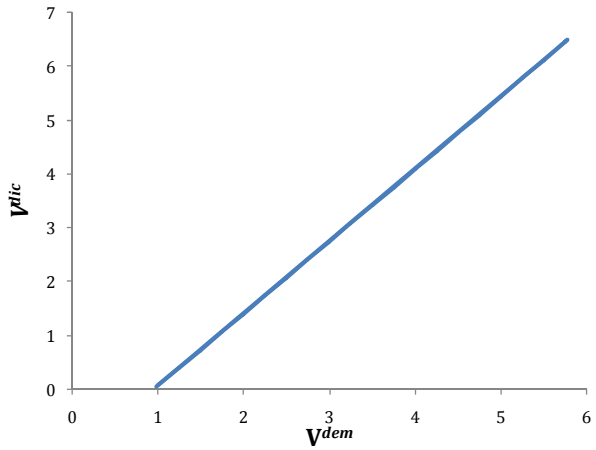
Figure 2.6: Relationship between V^{dem} and δ (Proposition 7)



The second can be seen by comparing V^{dic}given by equation 2.22 with V^{dem}, which gives: $V^{dem} > -\left(\frac{9}{4(1-\delta)}\right)$, which is true for all $\delta \in (0,1)$ in the relevant range of V^{dem}.

Figure 2.7 plots the value of dictatorship (the voters' welfare under dictatorship) for given values of V^{dem} (which is a function of k). This is driven by greater responsiveness on the part of dictators (see the bracket of the third term in (2.23): $V^{dem} - V^{dic}$ increases as V^{dem} increases) as well as greater probability of becoming a democracy, which is given by $\left(V^{dem} - V^{dic} - (1 + \theta_t)\right)$. Note that voter welfare is lower under dictatorship than democracy (and alternatively, corruption is greater under dictatorship than democracy) since democracy always has a higher value than dictatorship.

Figure 2.7: Relationship between the Values of Dictatorship and Democracy



Proposition 8. *The probability of becoming a democracy is a decreasing function of the informational cost k.*

Proof. Since V^{dem} is known to be a monotonically decreasing function of k I need to show that the probability of becoming a democracy is increasing in the value of

democracy. The probability of becoming a democracy is given by $Pr(\text{democracy}) = V^{dem} - V^{dic} - (1 + \theta_t)$. When I replace V^{dic} in that expression, I obtain

$$Pr(\text{democracy}) =$$

$$-1.25\left(\frac{1-\delta}{\delta}\right) + \left(\frac{1}{2\delta}\right)\sqrt{6.25\delta^2 - 3.5\delta + 4\delta(1-\delta)V^{dem} + 6.25} - (1 + \theta_t).$$ Taking the derivative with respect to V^{dem} yields $\left(\frac{(1-\delta)}{(6.25\delta^2 - 3.5\delta + 4\delta(1-\delta)V^{dem} + 6.25)^{\frac{1}{2}}}\right)$. This is greater than zero if $6.25\delta^2 - 3.5\delta + 4\delta(1-\delta)V^{dem} + 6.25 > 0$ or $V^{dem} > \left(\frac{1}{4\delta(1-\delta)}\right)(3.5\delta - 6.25 - 6.25\delta^2)$, which as can be seen in Figure 2.8 below is again true for all $\delta \in (0,1)$.

Figure 2.8: Relationship between V^{dem} and δ (Proposition 8)

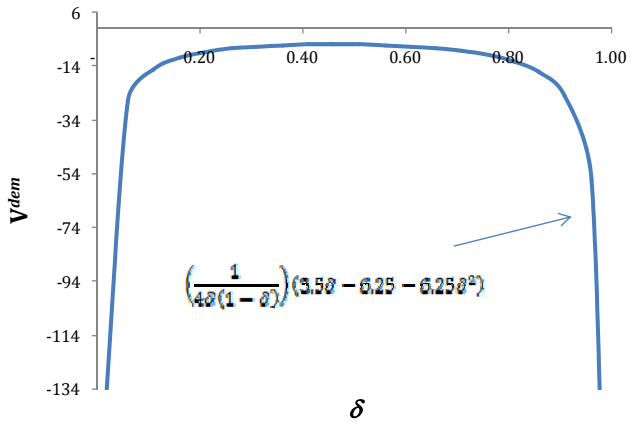
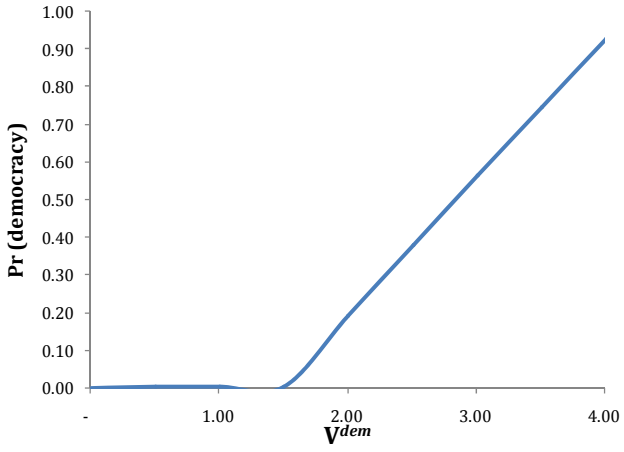


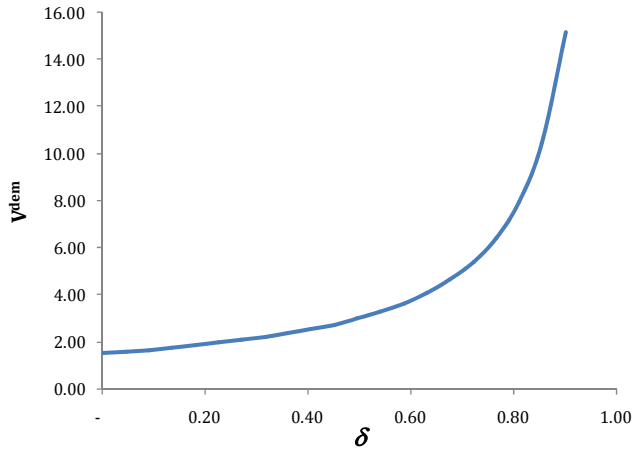
Figure 2.9 plots the probability of becoming a democracy compared to the value of democracy and shows that as information costs decrease, the average probability of transition to democracy increases:

Figure 2.9: The Probability of Democracy Increases in the Value of Democracy



I also consider what happens to the utility of the population under dictatorship when δ varies. As Figure 2.10 below shows, utility increases as voters and politicians become more patient. This effect is likely to be further increased when one considers that the current model does not incorporate long-term growth, which would further increase the incentives of a high-delta politician to be restrained in the extraction of state resources.

Figure 2.10: Utility increases as Voters become more Patient



Since the utility of the politician in this model is inversely proportional to the utility of the voters, the utility of the dictator is higher than that of a politician under a democracy. Because the incentive compatibility for the dictator (2.21) is more relaxed than that for the politician under a democracy and the value of dictatorship higher, I can conclude that (2.21) is satisfied.

Discussion: Huntington vs. Lipset

Seymour Lipset (1959) and Samuel Huntington (1968) were among the first scholars to write on the subject of the role of education on political development of 20th Century pre-industrial countries. One can crudely summarize their views, respectively, as "optimistic," in that Lipset believed that "good things" (namely democracy, education and development) came together, and "pessimistic," in that Huntington believed gains in education brought greater instability, which ultimately hindered the development process.

Lipset was one of the first to argue that the process of modernization led, in the political sphere, to democratization. Moreover, among the attributes of modernization, Lipset singled out education as possibly the most critical: "If we cannot say that a 'high' level of education is a sufficient condition for democracy, the available evidence does suggest that it comes close to being a necessary condition in the modern world." Education, Lipset argued, "broadens men's outlooks, enables them to understand the need for norms of tolerance, restrains them from adhering to extremist and monistic doctrines, and increases their capacity to make rational

electoral choices." Like Weber, Lipset identified modernization with widespread economic rationalism and viewed expanded education as a fundamental means towards that end. Moreover, Lipset also understood the correlation between education and income, and posited that lower levels of education would be associated with lower income and greater social discontent. Thus for example he states that "in Egypt … the cities are full of 'homeless illiterates,' who provide a ready audience for political mobilization in support of extremist ideologies." Thus according to Lipset, the lack of education would lead to instability and authoritarianism.

Lipset found ample empirical evidence for this thesis. Not only did he point to evidence of a strong correlation between the strength of democratic institutions and education across all countries, but he argues that even among poor countries in Latin America and the Arab League, those with the strongest democratic institutions were, by and large, also the ones where education was more widespread .

One can view Lipset's argument as an extension of modernization theory from the economic to the political arena: as society goes through a structural transformation that involves not only rising incomes but accompanying rising levels of education, the greater level of "rationality" in society makes it a more fertile breeding ground for democracy. "Rationality" may be interpreted to mean that voters pursue their long-term self-interest, and voters allow politicians who do not act on voter's best interests to stay in power not because they are irrational in a technical sense, but rather because they do not have the appropriate information about the behavior of politician. Lack of education, in my framework, is interpreted as less information, which as the model shows, increases the probability of continued dictatorship. In a

more complete model, one could think of interest groups taking advantage of the informational deficiencies of the population to gather support for authoritarian revolutions, as suggested by Lipset.

Huntington did not deny that stable, modernized, educated countries would be democratic but he forcefully challenged the linearity of the process. In his words, "modernity breeds stability but modernization breeds instability." Huntington understood the deep connection between education and economic modernization and that a modern state, "distinguished from the traditional state by the broadened extent to which people participate in politics and are affected by politics in large scale political units," was bound to be affected by education since it led to social mobilization: "(…) increases in literacy, education, and media exposure all give rise to enhanced aspirations and expectations which, if unsatisfied, galvanize individuals and groups into politics.". Huntington feared that the influence of the educated on the state would be disruptive exactly because educational expansion was bound to progress faster than opportunities for educated workers, thus leaving their "aspirations and expectations" unsatisfied and creating a class of disgruntled, educated unemployed. This class of individuals readily embraced radical and revolutionary ideologies, particularly communism. Thus, in sharp contrast to Lipset, Huntington argued that it was the educated, not the illiterate that represented the greatest threat to stability and, indirectly, to the modernization process itself.

His conclusion that the relationship between education and democracy was not linear was reinforced by empirical analysis. For example, Huntington found that "a division of countries according to their levels of literacy also suggested a bell-shaped

pattern of instability. Ninety-five percent of those countries in the middle range with 25 to 60% literacy were unstable as compared to 50% of those countries with less than 10% literacy and 22% of those countries with more than 90% literacy."

Huntington's argument can be summarized as saying that expansion of education promotes political instability because opportunities do not increase in proportion with the level of education. Political instability, in turn, disrupts the route to modernity, where stable democracies might actually emerge or be supported. Therefore Huntington appears to be making a veiled normative argument that the best way to achieve democracy is to repress it during the process of modernization, including in particular limiting the expansion of education. This would allow states to actually reach the stage of modernity, when democracy would then flourish.

The extensions of the model developed above show that both views are not incompatible: setting aside the important effect of education on long-run economic growth (greater wealth increases the probability of survival of democracy), I show a causal, though indirect, link between education, democracy and development when one interprets education as lowering the cost of obtaining information about the behavior of politicians. In particular, greater education increases the value of democracy and thereby increases the probability of transition from dictatorship to democracy, which is associated with lower corruption and higher incomes compared to a dictatorship. In the short term, however, Huntington's positive analysis is accurate as the model shows that the probability of revolution (and greater instability) increases with an exogenous increase in education. Such instability generates a decline in short-term economic growth that is not considered here, but ultimately increased

education leads to better economic outcomes because of more efficient provision of public goods by politicians.

Relation to the Literature

The current model consists in an attempt to integrate insights from the seminal models of Ferejohn (1986) and Townsend (1979). Ferejohn's model concerns the control of politicians through repeated elections when government outputs are imperfectly observed. Townsend's model introduced the notion of costly monitoring to induce truthful revelation of the state by the agent. The contribution of the present chapter is to integrate the two approaches and show the effect of costly information acquisition in the problem of controlling politicians.

The literature on repeated elections was initiated by Barro (1973), followed by Ferejohn (1986), who benefited from the insight on "retrospective voting rules" developed by Fiorina (1981). A model similar to Ferejohn's is developed by Persson and Tabellini (2000, Ch. 4.4). Barro's and Ferejohn's model, as well as the model of Austen-Smith and Banks (1989) are strictly moral hazard models, as they share the feature that all politicians are equally competent (or honest) and only the politician's "efforts" are imperfectly observed. Rogoff and Sibert (1988) is generally regarded as the first model of pure adverse selection, where voters try to select more competent politicians through the electoral process, though this tends to generate a "political business cycle" whereby less competent politicians try to appear more competent by generating an election-year boom. Banks and Sundaram (1993, 1998) and Ashworth (2002) combine adverse selection with moral hazard in their models. Banks and

Duggan (2000) and Duggan (2000) are also primarily concerned with adverse selection, as the preferences of candidates are not known to the voters and pre-election commitments are not feasible. The model in Meirowitz (2002) is more in the moral hazard vein, although its main contribution is to consider a two-dimensional policy space where moderate voters are unsure whether extremist politicians are constrained by (imperfectly observed) relative prices of each policy dimension, or whether they are shirking their electoral promises of moderation.

Fearon (1999) reviews the literature and argues that the selection problem is more salient than the control problem. As noted by Meirowitz (2002), however, Besley and Case (1995a, 1995b) find evidence that "(1) voters reward governors that outperform those of neighboring states and (2) term limited governors tend to shirk in fiscal policy-making relative to non-limited governors." (Meirowitz 2002, p. 3).

A closely related paper is Adserà, Boix and Payne (2003), who also develop a theoretical model of the implications of better information for political control, but their approach is different: they model improved information as "shrinking" the support of the distribution function observed by voters, whereas in this chapter we model informational costs directly. The main goal of that paper, however, is to directly test whether countries with more informed electorates indeed have lower levels of corruption. The authors find that the quality of government is higher when voters are better informed (as measured by circulation of daily newspapers) as well as in democracies (although the effect of the latter is much smaller), findings consistent with the result of the models in this chapter.

In addition to Adserà, Boix and Payne (2003), the empirical literature provides additional support for the findings of the model. For example, Strömberg (2004) shows that voters with greater access to radio (and who were thus better informed) were able to demand greater benefits from a federal relief program during the depression. Besley and Burgess (2001, 2002) show that, in India, areas where newspaper circulation was higher (and thus where voters were better informed) were more effectively served by a disaster relief program. Evidence in favor of the agency model of politics was first seriously considered by Besley and Case (1995b), where they show that governments subject to term limits who were in their last term spent more and taxed more, leading to lower income per capita in their states.

Discussion and Conclusion

I showed in this chapter that electoral control is linked to the cost of voters acquiring information about politicians. Perhaps more importantly, politicians have an important influence over the noise observed by voters. Governments can (and do) not only influence the media, but they influence the educational system, which substantially contributes to voters' abilities to monitor the political system. This argument is best exemplified by illiteracy: if the voters cannot read newspapers and they are too poor to own a television set (or television stations are under government censorship), they are forced to rely on word of mouth as their only source of knowledge of government activities. The extension to the model developed in this chapter illustrated the perverse incentives governments face given the choice of

adopting a policy that is both growth enhancing but that may also reduce the ability of politicians to collect rents.

In addition to education, the role of the media and public information campaigns is also important and should be analyzed, particularly in more empirical work. Empirical work on the subject is very difficult due to severe endogeneity problems: rising incomes are driven (and drive) higher levels of education and lower levels of corruption.

Finally, an extension of potential interest would be to embed the political economy model developed in this chapter into an economic growth model where human capital is one of the factors of production. Given the findings about the perverse incentives and transition to democracy, such an extension could shed some light on models with multiple steady-state growth rates such as those in Lucas (2002): absent exogenous shocks to the demand for education, countries may be trapped in a low-human capital, high-corruption, and therefore low-growth environment that persists because politicians fail to make needed investments in human capital accumulation.

Annex

Equilibrium with costly information acquisition: an alternative rule

For completeness, I consider whether voters may not be better off by selecting the following rule when information acquisition is costly: if $u_t > u$, audit the politician and otherwise fire her. I show that this rule is sub-optimal for all values of k.

The incumbent's choices are summarized by:

$$r_t = \begin{cases} 0 \text{ if } 1 + \theta_t \geq u \text{ and } \delta V^I \geq 1 \\ 1 \text{ otherwise} \end{cases} \quad \Longrightarrow \quad v(r_t, \theta_t) = \begin{cases} \delta V^I + w \\ 1 \end{cases} \tag{A2.1}$$

, where we assume $b = 1$ for simplicity. The relevant IC condition is $\delta V^I \geq 1$ but I also need to worry about $1 + \theta_t \geq u$. The voter's expected (period) utility is given by:

$$Eu(r_t, \theta_t) = (1 + \theta^m - k)[1 - F(u - 1)] \tag{A2.2}$$

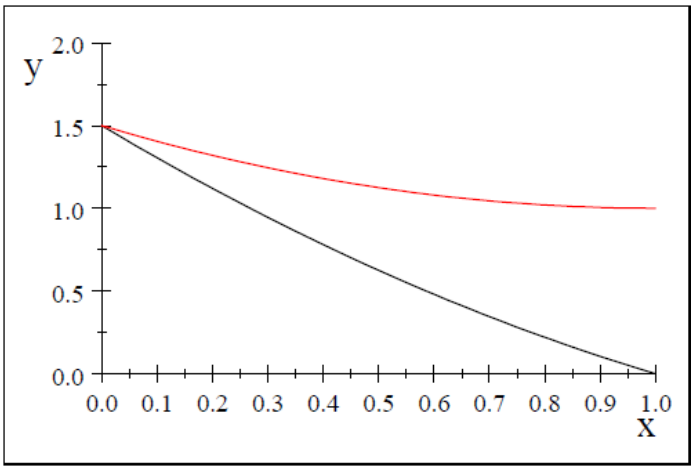
Proposition A1. *The optimal retrospective voting rule when voters may learn the value of the shock θ_t by paying a cost k and assuming shocks are uniformly distributed over* (0,1) *is given by*

$$u = 1 + k \tag{A2.3}$$

Moreover, this rule always yields lower voter welfare compared to the previous rule.

Proof. To obtain the optimal retrospective voting rule I consider the solution to the voter's maximization problem: $\left(\frac{\partial \theta^m}{\partial u}\right) - f(u-1) + kf(u-1) - f(u-1)\theta^m - F(u-1)\left(\frac{\partial \theta^m}{\partial u}\right) = 0$, which yields utility $Eu(r_t, \theta_t) = \left(1 + \left(\frac{1+k}{2}\right) - k\right)(1-k) = Eu(r_t, \theta_t) = \left(\frac{1}{2}\right)k^2 - 2k + \left(\frac{3}{2}\right)$. As can be seen in Figure A1 below, voter utility is always lower under this alternative rule.

Figure A.1



The problem with this rule is that positive utility requires auditing, so regardless of where u is set, positive utility requires payment of k (note that the second term doesn't depend on u).

Notes

1. Incidentally, the argument that colonialism of different types created persistent institutions that either favored or hindered growth is not new, having been taught for many years to Brazilian high school students in world history.
2. Kohli (2004) has a thorough discussion of the problem of varying state capacity.
3. This can also be derived directly from $(2b-k)\log\frac{2b}{2b-k}-k\leq 0$ by noting that $\log\frac{2b}{2b-k}<1$ for $b>k$.
4. I thank Arnaud Costinot for this insight.

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3

Odious Debt as a Principal-Agent Problem[1]

In principle, debt is contracted by a country's government on behalf of its population for the purpose of providing public goods, such as public investments or consumption smoothing. However, because of asymmetric information between governments and the population, public debt is sometimes used instead for the private benefit of government officials, including for ensuring their hold on power by repressing the population through violent means. The concept of "odious" debt—traditionally defined as debt incurred without the consent of the population and not for their benefit (Sack 1927)—is therefore closely related to a principal-agent problem in which, because of limited observability of the actions of governments, the agents contracting debt (the government) do not use it for the benefit of the principals (the population), who are ultimately responsible for repaying it.

A number of civil society organizations have called for the cancellation of such odious debt, arguing that creditors should bear responsibility for aligning the interests of governments and their populations. These advocates suggest that this can be accomplished by restricting loans to certain types of governments or spending

resources to ensure that loan proceeds are used for the benefit of the population. Lenders who fail to do so would lose the right to enforce their claim through the courts. This chapter analyzes the implications of this policy proposal for the welfare of the populations using a game-theoretical framework that models the principal-agent problem between governments and populations.

Borrowing—whether by governments or private entities—is characterized by at least two agency relationships: one between borrowers (the agents) and creditors (the principals), another between the actors responsible for contracting debt (the agents) and those who ultimately bear the burden of servicing it (the principals). Both problems must be solved by providing agents with appropriate incentives so that their interests are aligned with those of the principals. Although the nature of the problems of sovereign and private borrowing is similar, their solutions are fundamentally different.

The agency problem between borrowers and creditors is straightforward: having contracted debt, absent any constraints, the borrower would prefer not to repay it. The solution to the problem depends on the availability of appropriate incentives for debt repayment. Creditors of firms can rely on the legal system to credibly reassign the property rights of assets from the borrower to the creditor in case of default.

The transfer of property rights from a sovereign borrower to its creditors through the courts poses substantial challenges, as noted by several authors at least since Eaton and Gersovitz (1981). Creditors would not be expected to be able to attach assets located in the borrowing country (although there have been exceptions in

the past),[2] and any judgments obtained in foreign courts would (generally) be enforceable only in those jurisdictions and therefore limited to assets located therein. Although cross-border enforcement is possible in principle (through gunboats, for example), there is widespread agreement that such enforcement is politically untenable today.[3] Some authors argue that, in the absence of direct enforcement, sovereign borrowing needs to be self-enforcing through market reactions, such as higher interest rates, credit rationing for defaulting countries, or both. The precise nature of the enforcement mechanisms available to creditors of sovereign nations, as well as the empirical evidence for the effectiveness of different mechanisms, has been the subject of an extensive body of literature, discussed in detail in Dömeland, Gil Sander, and Braga (2009).

This chapter focuses instead on the principal-agent problem between those responsible for negotiating and contracting loans and those who ultimately bear the costs of repayment. In the case of a company, management makes borrowing decisions, but shareholders ultimately bear the costs of debt service. In the case of sovereign borrowing, governments are responsible for negotiating and contracting loans, but the country's population bears the burden of debt service through future taxation. In both cases, the parties responsible for entering into the loan contract may not be in the same position at the time the loan must be repaid, and in both cases, the agents may attempt to invest in overly risky projects or to misappropriate the proceeds of the loans for their own benefit.[4]

In the case of private borrowing, the solution to the problem lies in collapsing the agency relationship to ensure that the borrower and payer are the same (as is the

case of consumer borrowing or borrowing by a sole proprietorship or partnership) or enforcing shareholder protection laws, such as those that require the disclosure of information and create civil and criminal liability for executives that provide false or misleading information. Managers in private firms may have incentive contracts that condition their compensation on performance.

In the case of sovereign borrowing, the solution to the agency problem must rely on more limited mechanisms. With the possible exception of a very small number of countries in which the national wealth is indistinguishable from that of its rulers, collapsing the agency relationship is not possible. The enforcement of anticorruption and transparency laws (analogous to the laws that protect shareholders from management fraud) is ultimately conducted by the government itself; new agency problems emerge that make the enforcement of such fiscal probity laws less effective than that of private contracts. Perhaps most important, contingent compensation contracts for government leaders do not seem to exist in practice (for example, in no country does the president or prime minister earn a bonus for exceptional economic growth).[5] The only form of incentives provided to government executives is the possibility that they can be replaced.

This agency problem between governments and the population they serve is ultimately at the heart of the debate over the cancellation of odious or otherwise "illegitimate" debt. This category of debt—which in this chapter also includes "war," "ineffective," "regime," and "subjugation" debt—is characterized by the fact that the proceeds from the borrowing were not used for the benefit of the population of the country. The cancellation of odious debt, it is argued, would help correct for the

incentives for governments to use loan proceeds in the interests of their populations by pressuring lenders to ensure that loans are made only to governments—or purposes—that are aligned with the interests of the population.

There are essentially three types of proposals in this regard. The first, advocated by many civil society organizations, is to audit existing debt portfolios and repudiate debt deemed illegitimate. This would correct the moral hazard problem ex post (from the point of view of the population) and create incentives for lenders to be more careful in future lending, because they would always face the risk of a debt audit.

The second proposal, put forward by Bolton and Skeel (2007) and Jayachandran and Kremer (2006), would be for an international body (such as the United Nations [UN] Security Council) to declare regimes odious ex ante, in which case all loans contracted by the odious regime would in principle be repudiated by the successor government. In a related version of this proposal, once a regime is deemed odious, only loans that could be justified as benefiting the population would not be repudiated later.

A third proposal, aimed at ensuring that loan proceeds are used judiciously but without affecting the enforceability of loans, is that of "responsible lending." This proposal calls for greater oversight of all sovereign lending by creditors (for example, by suspending loan disbursements if serious corruption problems are encountered in the project the loan is financing) (see, for example, Nehru and Thomas 2009).

This chapter considers the impact of the three types of proposals in an agency model of politics in the vein of Ferejohn (1986) and Persson, Roland, and Tabellini

(1997), in which the primary incentives provided to government executives are the possibility that they can be replaced—through elections in a democratic environment or through the overthrow of the government in a nondemocratic one. The model is modified to include two features relevant to the odious debt debate, namely, that governments finance their activities partly by borrowing from foreign creditors and that governments may seek to remain in power by using government resources to provide public goods to the population or to repress the population through violence.

The chapter is organized as follows. The first section discusses the relation between this chapter and the literature on odious debt. The second section presents a simple political agency model with international borrowing, in which governments may engage in borrowing for investments or repression. The third section describes the equilibrium of the model under the baseline of no changes to the current international debt market and then compares the welfare properties under the benchmark with those arising from the three proposed odious debt frameworks. It also extends the model in order to analyze the implications of an odious debt framework for the likelihood of collusion between creditors and odious regimes. The last section summarizes the chapter's conclusions and discusses possible extensions of the model.

Relation to the Literature

An extensive body of literature debates the existence of an odious debt doctrine in international law, proposes alternative formulations for a new or expanded framework for the cancellation of odious debt, and discusses alternatives for its implementation (see Nehru and Thomas 2009 for a summary of the literature). In

contrast, few studies consider the problem from the point of view of economic theory. Those that have (Kremer and Jayachandran 2002; Jayachandran and Kremer 2006; Choi and Posner 2007) do not explicitly analyze the impact of an odious debt framework on the political agency problem ultimately at the heart of the debate, and none explicitly models the politics involved.

Jayachandran and Kremer (2006) and the working paper version (Kremer and Jayachandran 2002) consider a model in which an odious regime borrows to smooth consumption. The authors develop an equilibrium model of sovereign credit markets, which are supported by the possibility that creditors may seize overseas assets of borrowers. Under a legal framework of loan sanctions, this transfer of assets in case of nonpayment is precluded when a loan is made to an odious regime, which eliminates equilibria with lending to that regime. This result depends, however, on successor regimes always being nonodious. In the model, the imposition of loan sanctions increases the welfare of the population, which would no longer be saddled with debt that had not been used for their benefit.

Choi and Posner (2007) note that the argument in Jayachandran and Kremer (2006) also depends on odious governments always wasting loan proceeds. They point out that loan sanctions would not necessarily dry out funding to odious states but only increase the costs of finance, because default would occur if the dictator were overthrown but debt would likely be repaid as long as the odious regime were still in power and seeking new loans. If dictators remain in power when their loans come due, they would repay them in order to access new loans, implying a positive probability of repayment even for an odious regime under loan sanctions. Choi and Posner consider

the impact of an increase in loan costs on the consumption-investment choice of odious governments. Their model—which assumes that the probability of overthrowing the dictator is the same regardless of whether the dictator consumes or invests the loan proceeds—actually suggests that loan sanctions do not change the incentives of odious governments. In order to have an effect, implementation of the odious debt doctrine must also increase the probability of overthrowing the dictator (they argue that this would be the case because the benefits to the population of overthrowing the regime are greater if the new regime can then repudiate its debt). In this case, under certain parameter values, populations are worse off under loan sanctions.

Allowing successor governments to repudiate debt incurred by previous regimes does not necessarily increase the likelihood of overthrowing a dictator. The evidence from trade sanctions is mixed (regimes subject to trade sanctions are not more likely to be overthrown), and in any case, new representative governments already have the possibility of repudiating their predecessors' debt. Successor regimes usually honor debt because of fear of legal penalties if they repudiate but also (perhaps mainly) because of possible market penalties that cannot be legislated away. The assumption that introducing an odious debt doctrine increases the likelihood of the regime being overthrown also appears to be at odds with the idea that the probability of replacing the regime is unaffected by the government's choice between investment and consumption, which has a direct impact on the utility of the population in the model.

This chapter departs from Jayachandran and Kremer (2006) in several respects. First, as in Choi and Posner (2007), the motive for borrowing may be investment

rather than consumption smoothing. Empirical evidence for a consumption-smoothing motive for sovereign borrowing is weak at best: Levy-Yeyati (2008) shows that sovereign borrowing by developing countries is pro-cyclical rather than countercyclical. The motive for repayment is not central to the model presented here, which simply assumes the existence of an exogenous punishment against default.

The main difference between this chapter and the existing economics literature on odious debt is the explicit modeling of the principal-agent relationship between the government and its population. Modeling the relationship in this way allows for the analysis of the effects of different policy prescriptions on both the incentives for a government to use repression and its incentives to invest in public goods.

The Model

In this section, I motivate and set up a simple model with which to analyze the implications of different odious debt frameworks on the welfare of the populations under both odious and nonodious regimes. Although the model is highly simplified, it captures the trade-off governments must make between trying to remain in power by providing public goods or using violence, and it allows analysis of the implications of different proposals for the cancellation of odious debts on this trade-off.

Motivation and Setup

I model the relationship between the government and the population as a principal-agent problem: the population "hires" the government to deliver certain public goods on its behalf, but the incentives of the government are not naturally aligned with those

of the population, because the politicians in the government may prefer to divert resources for their private consumption rather than investing those resources in the delivery of public goods. As in Ferejohn (1986) and Persson, Roland, and Tabellini (1997), voters may control the government by threatening to replace politicians unless they deliver a minimum level of public goods. In the model, the government can remain in power by delivering public goods or by using repression and violence. I denominate governments that choose repression as a means to remain in power as odious, but it is important to note that even nonodious governments may act against the interests of the population by exploiting information asymmetries.

The motivation for borrowing in the model comes from a nonlinear (bulky) technology for public investments, for which the government is assumed to have insufficient resources in the first period. Because the investments have positive expected net returns, it would therefore be optimal to borrow. Borrowing (or at least some borrowing) may also take place to finance repression, government consumption, or redistribution.

This chapter does not consider the reasons why governments repay their debt in the first place (this is a fundamental question of international finance, because creditors' ability to enforce their claims through the legal system is far more limited against countries than against firms). The literature identifies a number of possible channels that compel countries to repay their debt, including reputational costs; penalties, such as litigation costs or trade sanctions; limitations on access to finance in the short term; and long-term increases in the cost of finance. There is no consensus as to the relative importance of these channels from an empirical perspective, and even

the theoretical literature is divided: the classic article by Bulow and Rogoff (1989) argues that reputational costs alone are not sufficient to prevent strategic defaults, whereas other authors (for example, Wright 2003) suggest that reputation among creditors allows for borrower reputation to have value. In this chapter, I simply assume that some enforcement mechanism exists and that loan sizes are limited by a hypothetical penalty cost.

Because I rule out inability to pay (by assuming that revenues in the repayment period are always greater than the loan size), default can occur only when default penalties are removed. Although it is not at all clear that implementing an odious debt framework removes the costs of default discussed above, I take this as a best-case scenario assumption. Therefore, if the odious debt framework is in place, countries default when the framework allows them to do so.

Production

Consider an economy with just two goods, guns and butter. Guns are consumed only by the government for the purpose of repressing the population and remaining in power. Butter may be consumed by both the population and the government. Guns are not produced domestically; they must be imported (or smuggled) into the country. Butter is perishable and cannot be imported, but it may be produced domestically if the government builds a milk-processing plant. Building the butter factory requires a risky lump-sum investment: a fixed amount I is required, with a positive probability that it will be diverted (because of corruption, civil strife, or other factors) or otherwise considered unsuccessful, in which case nothing is built. If the investment is

successful, it has both private (internal) and public (external) returns (through the creation of employment, the building of roads needed to transport the butter to town, and so forth).

The production function for butter is given by

$$y_t = (1 + x)I_t\theta_t \tag{3.1}$$

where I_t is the investment, x is the public (external) returns, and θ_t is the stochastic returns that are identically and independently distributed such that with probability p the return is $\theta_t = \theta > 1$ and with probability $1 - p$, $\theta_t = 0$ (that is, the project fails). Investment is lumpy, such that $y_t = 0$ for $I_t < I$ and $y_t = n(1 + x)I\theta_t$ if $(n + 1)I < I_t < nI$ (therefore, it is optimal to invest only in multiples of I). I later make an assumption on the available financing to ensure that $I_t \in \{0, I\}$. Governments have an endowment $b_1 < I$ in the first subperiod and therefore must borrow to build the butter factory. In the second period the government collects domestic revenues of b_2. There are no domestic or external savings available to the government.

Credit Markets

We consider competitive, risk-neutral commercial lenders who are assumed to behave according to the nonarbitrage condition

$$(1 - p_D)(1 + i)d + p_D R = (1 + j)d \tag{3.2}$$

where p_D is the probability of default, i is the interest rate charged to the borrower, R is the recovery value in case of default, and j is the risk-free world interest rate. For

simplicity, I assume that $j = 0$ and $R = 0$, so that the no-arbitrage condition reduces to $1 + i = \left(\frac{1}{1-p_D}\right)$.

As noted above, I do not explicitly model the question of why sovereign borrowers repay their debt at all. Instead, I assume that a punishment P is available to lenders such that they can make loans as large as D (where D is such that $2I > D + b_1 \geq I$ and be ensured of payment as long as the country has the resources to pay, which I also assume. I do not separate the portion of P attributable to reputational or legal costs (that is, the portion of the punishment that may be removed by an odious debt framework). In addition, by precluding loans that would allow investments of $2I$, I simplify output by restricting the analysis to $y \in \{0, (1 + x)I\}$.

Because D is fixed, I assume, as a convention, that $d = \frac{D}{1+i} = D(1 - p_D)$ are the loan proceeds, which vary with p_D, and that D is the fixed repayment amount consistent with P.[6] I assume $b_2 \geq D$, so that without an odious debt framework $p_D = 0$ and $D = d$. Therefore, under the base case, there are no defaults in equilibrium regardless of regime type or use of the loan. This reflects evidence that potentially odious regimes are no more likely to default than nonodious ones, including in the case of transition from odious to nonodious regimes (as was the case in post-apartheid South Africa).

Creditors cannot costlessly observe whether loan proceeds are used for consumption, repression, or investment, but a monitoring technology is available at a fixed cost k. Because creditors are competitive, the verification technology will not be

used in equilibrium unless the choice between repression and consumption affects the probability of default (and therefore their profits).

Politics

Governments maximize their own utility subject to the constraint that they may be replaced by the population. There are two possible political systems: one in which governments spend resources on repression, another in which incumbent governments forgo repression and rely instead on the provision of public goods to garner electoral support to remain in power. Broadly speaking, the political systems can be characterized as dictatorship and democracy, where democracy refers to a political system in which voters may hold politicians accountable on the basis of delivery of public services.

Let g denote expenditures on guns. To keep the model simple, I assume that if the government spends an amount $g_t = G$, it remains in power with exogenous probability q and that there is no benefit to spending anymore. Therefore, $g_t \in \{0, G\}$. (Later, I provide a possible motivation for the probability q as the probability of the realization of the actual costs of keeping power.) In the model, I term odious those governments that choose $g_t = G$. Because even odious regimes that invest capture the entire private output of the investment, the population is always better off with a nonrepressive regime. I assume that $b_1 \geq G$, so that the government may engage in repression even without external borrowing. This seems to be a reasonable assumption, given that many countries that are currently cut out of the international financial system nonetheless find resources to spend on repression.

When governments choose $g_t = 0$, voters use a retrospective voting rule based on minimum utility cutoff. That is, they reelect governments that provide at least a minimum utility level and otherwise elect a new government.

A key assumption needed for the tractability of the model is that the external effects of investments are not observable to voters at the time of the election and that voters therefore must base their decision only on the private output of the factory. I motivate this assumption by noting that external effects sometimes benefit only the next generation of voters, as may be the case, for example, if previously credit-constrained workers in the factory can now afford to educate their children. Voters observe only $(1-\gamma)I_t\theta_t = \{0, (1-\gamma)I\theta\}$, where γ is the fraction of the investment's output captured by the government as rents. Because I and γ are exogenous, the rule is equivalent to setting a threshold on γ.

To ensure that the game is stationary and to focus on the moral hazard problem, I assume that each country has only one type of politicians, with the type given by the level of "ego rents" w they receive from being in power (politicians with higher w are more attached to power than those with lower w). In practice, different countries may have different types of politicians; I assume that a given country only has one type.

Finally, I assume that the present value of costs from allowing a government always to expropriate the private output of investment for a current voter is greater than the external benefits for future generations. Therefore, each generation of voters is indifferent between a kleptocrat (who appropriates all private output but invests) and an autocrat who does not invest.

Preferences and Government Budget Constraint

I assume that both the population and the government are risk neutral and have linear utility functions. For simplicity, there is no discounting. The instantaneous utility function of the population of generation g at time t is given by

$$u_{g,t} = (1-\gamma)I_t\theta_t + (xI\theta)_{g-1} + b_2 - D \tag{3.3}$$

As noted above, the benefits of private investment affect the utility of the next generation only. The government's instantaneous utility function is given by

$$v_t = w + d + b_1 - g_t + (\gamma\theta_t - 1)I_t \tag{3.4}$$

Governments maximize the expected utility function

$$E[v_t] = w + d + b_1 - g_t + (\gamma\theta_t - 1)I_t + Pr[reelection]\, V^{B,G} \tag{3.5}$$

where $V^{B,G}$ are continuation values for governments that choose, respectively, to build butter factories or buy guns. Utility is maximized subject to the government's budget constraint:

$$d + b_1 \leq g_t + I_t \tag{3.6}$$

as well as by constraints on reelection.

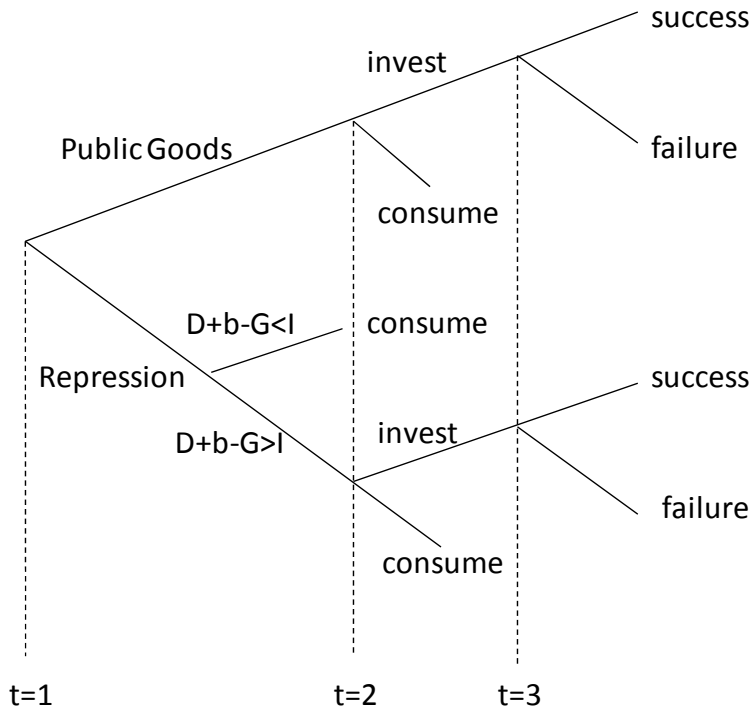
Timing

I consider an infinitely repeated game with three subperiods (Figure 3.1). In subperiod 1, the government contracts a loan and decides whether to remain in power through repression (that is, buy guns) or through the provision of public goods. In subperiod 2,

the returns to investing are revealed and the government decides whether to divert the investment for consumption or undertake the investment. In subperiod 3, the population observes the output, the loan is repaid, and elections take place.

Note that once the government chooses to consume the proceeds of the loan, elections are trivial because the government either accepts that it will not be reelected or knows that it will remain in power through the use of repression. In addition, the assumptions on timing ensure that the government will never undertake a failed investment, choosing instead to consume the loan proceeds, because voters would observe the same outcome.

Figure 3.1: Sequence of Actions in an Infinitely Repeated Game with Three Subperiods



Equilibrium

I begin by analyzing a benchmark model of international debt markets without an odious debt framework in place; this is the baseline against which I compare the models modified with the different frameworks. Two cases must be considered depending on the budget constraint faced by the government. The first corresponds to governments that cannot afford to engage simultaneously in repression and investment (that is, $d + b_1 - G < I$). The second corresponds to governments that are able to undertake both activities (that is, $d + b_1 - G \geq I$). Following the analysis of the baseline case, I analyze the three proposed odious debt frameworks and compare them with this baseline.

Baseline Case 1: Odious Regimes Cannot Invest

Consider the case in which the government's budget constraint (equation 3.6) is characterized by $d + b_1 - G < I$, with $d = D$. In this case, the government's choice to use repression precludes it from also investing. The government then has three choices: use repression, forgo repression and invest, or forgo repression and consume. The incentive-compatibility constraint for the government to choose to enter electoral politics rather than to engage in repression is given by

$$w < \left(\frac{(1-p)G+(1-q)p(\gamma\theta-1)I}{q-p}\right) - D - b_1 \tag{3.7}$$

The right-hand side of equation (3.7) is increasing in G, because the higher the cost of repression, the smaller the number of types of politicians that will avail themselves of repression. It is also increasing on I as long as $\gamma\theta > 1$ (that is, if the

investment yields positive returns to the government), and it is monotonically increasing on γ and θ only if $q > p$, which I assume to be true. This implies that the probability of staying in office is greater for the repressive government than for the "democratic" government, which makes sense because otherwise, investment strictly dominates repression. The assumption that the government observes θ before investing guarantees positive returns; if investment also ensured a higher probability of reelection (that is, if $p > q$), there would clearly be no use for repression.

As $q - p$ decreases, more types of politicians choose to provide public goods rather than engage in repression. Therefore, $q - p$ can be viewed as an institutional variable. In fact, in many developing countries, the probability of the success of public investments does appear to be lower (even if the returns may be high) because of capacity and other institutional constraints; in contrast, the probability of staying in power that can be "bought" for a fixed amount is likely decreasing on the level of income, as the population has more at stake and would be more compelled to overthrow a dictator. Another consequence of the magnitude of $q - p$ is that decreasing resources make investment more likely (as long as it is affordable), because the benefits of staying in power are a function of the residual (that is, net of spending on guns and investment resources). Therefore, fewer residual resources reduce the benefit of staying in office (which is biased toward repression by $q > p$.

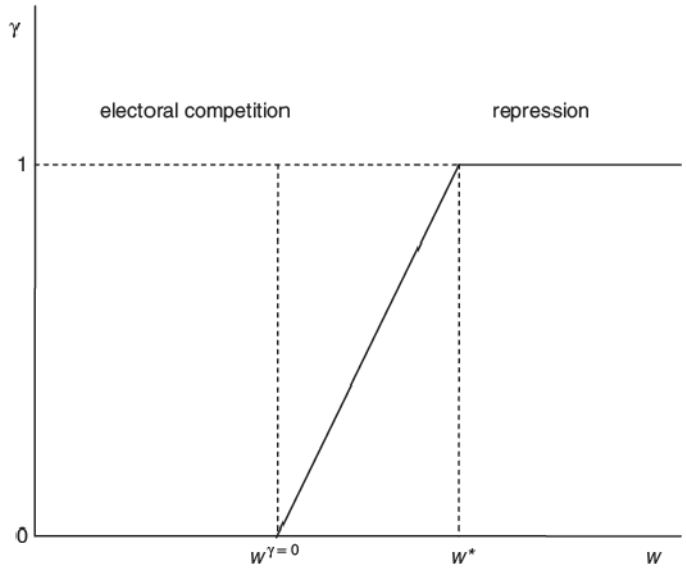
The equilibrium entails manipulating equation (3.7) to identify $w = w_1^*$, the level of the ego rent parameter above which politicians choose repression regardless of the level of γ, and γ^*, the optimal fraction of the output that voters must allow politicians to appropriate when $w > w_1^*$ to ensure that investment is incentive

compatible. Naturally, the higher w_1^* is, the larger the number of types will choose to abstain from repression, and the lower γ the higher the utility of voters. Proposition1 summarizes the equilibrium (all proofs appear in the annex):

Proposition 1. *For the case where* $d + b_1 - G < I$, *governments always choose to engage in repression when* $w > \left(\frac{(1-p)G+(1-q)p(\theta-1)I}{q-p}\right) - D - b_1 \equiv w_1^*$. *When* $w \leq w_1^*$ *governments choose to engage in electoral competition and are re-elected if they deliver utility* $u \geq (1-\gamma_1^*)I\theta + b_2 - D$, *where* $\gamma_1^* \in \{0, \gamma_1\}$ *is the optimal fraction of investment returns that are transferred to the government in the form of rents. For* $w \leq \left(\frac{(1-p)G-(2p-1)(1-q)I}{q-p}\right) - D - b_1 \equiv w_1^{\gamma=0}, \gamma_1^* = 0$ *and for* $w_1^{\gamma=0} < w \leq w_1^*$, $\gamma_1^* = \gamma_1 = \left(\frac{(w+D+b_1)(q-p)-(1-p)G}{\theta I(1-q)p}\right) + \left(\frac{2p-1}{\theta p}\right)$.

Proposition 1 shows that there are two cutoffs for w that in turn give rise to three regions for w: (a) $w > w_1^*$ (repression is always chosen); (b) $w_1^* \geq w > w_1^{\gamma=0}(\gamma^* = \gamma^1 > 0)$; and (c) $w \leq w_1^{\gamma=0}(\gamma^* = 0)$. (Figure 3.2) Note that in case (b) the population must accept a higher level of γ than required simply to provide incentives for a politician to invest rather than consume. Therefore, the threat of repression forces higher transfers to the government. Note that whether a government is odious depends on its type. However, where a government falls in the spectrum (that is, how close to w_1^* it is) will affect the consequences for any odious debt framework.

Figure 3.2: Relationship between Level of "Ego Rents" and Required Transfer to Government



The model has two potentially interesting features that are applicable to developing countries. The first is the role that the threat of repression plays in increasing the rents that accrue to the government. For the intermediate w types, governments may be able to extract more rents under a democratic setting by threatening (though not actually using) repression. In this simple model, where the incentive compatibility for investing rather than consuming the loan investment amount is always met (see the proof in the annex), $\gamma^* > 0$ provides a measure of the threat of repression and is decreasing on the returns to investment (θ) and the cost of repression (G), but increasing on w, D and b_1.

The second feature is the "natural resource curse." As discussed earlier, as long as engaging in repression provides better chances of remaining in power than does delivering public goods (that is, $q > p$), a higher endowment b_1 makes investment less

likely up to the point at which both investment and repression become affordable. But, as shown below, even as a higher endowment makes investment affordable, repression will still be used to ensure the government's hold on power.

Baseline Case 2: Odious Regimes Can Invest

The analysis of the case in which odious regimes may invest is similar to the first case, except that the benefits of engaging in repression are greater, because the government can accrue the full output of the investment project and incur only a probability $(1-q < 1-p)$ of being replaced. The government must still trade off these benefits with the cost of repression. The government has four choices: use repression and invest, use repression and consume, forgo repression and invest, and forgo repression and consume.

The incentive-compatibility constraint for the government to choose to enter electoral politics rather than to engage in repression is given by

$$w + D + b_1 < \left(\frac{1-p}{q-p}\right) G + \left(\frac{1-q}{q-p}\right)(\gamma\theta - 1)pI - \left(\frac{1-p}{q-p}\right)(\theta - 1)pI. \tag{3.8}$$

As in the previous case, I derive the cutoff values of w that indicate when the government will always choose repression and when the governments will not require transfers in order to provide the public good.

Proposition 2. *In the case in which $d + b_1 - G > I$, governments always choose to engage in repression when*

$$w > w_2^* = \left(\frac{1-p}{q-p}\right) G - (\theta - 1)pI - D - b_1.$$

When $w \leq w_2^*$, *governments choose to engage in electoral competition and are reelected if they deliver utility* $u \geq (1-\gamma_2^*)I\theta + b_2 - D$, *where* $\gamma^* \in \{0, \gamma_2\}$ *is the optimal share of investment returns that must be transferred to the government in the form of rents. For* $w \leq \left(\frac{(1-p)G-(2p-1)I(1-q)}{q-p}\right) - D - b_1 \equiv w_2^{\gamma=0}$, $\gamma_2^* = 0$; *for* $w_2^{\gamma=0} < w \leq w_2^*$, $\gamma_2^* = \left(\frac{(w+D+b^1)(q-p)}{(1-q)pI\theta}\right) + \left(\frac{(1-p)(\theta-1)+1-q}{(1-q)pI\theta}\right)pI - \left(\frac{(1-p)}{(1-q)\theta}\right)\left(\frac{G}{pI}\right)$.

As in Baseline Case 1, there are two cutoff levels of w that give rise to three regions: (a) $w > w_2^*$ (repression is always chosen); (b) $w_2^* \geq w > w_2^{\gamma=0}$ and $\gamma_2^* > 0$; and (c) $w \leq w_2^{\gamma=0}(\gamma_2^* = 0)$, where $w_2^{\gamma=0}$ is the cutoff above which $\gamma_2^* > 0$, given by $\left(\frac{1-p}{q-p}\right)(G - \theta pI) - D - b_1$.

Note that $w_1^* > w_2^*$, which is consistent with the fact that more types of government will engage in repression given the added ability to undertake investments. In general, a higher w^* implies higher expected welfare, because it is associated with fewer types above w^* that engage in repression. Other comparative statics are similar to those in the previous case. Notably, a small difference between q and p leads to higher values of w_2^*, making repression less attractive. As noted above, although a higher b_1 may eventually increase welfare by allowing the country to invest, as long as $q > p$, the government will continue to engage in repression.

Ex Ante Framework (Loan Sanctions)

I consider an ex ante odious regime framework in the vein of that suggested by Jayachandran and Kremer (2006), whereby an appropriate institution(for example,

the UN Security Council or the International Monetary Fund) would declare a regime odious, in which case all loans made to it from that point on would be unenforceable by the relevant courts and the usual default provisions in commercial or official debt contracts would not be triggered. The key feature of the ex ante framework is that the debt of the odious regime must be considered legitimate until the appropriate institution declares it odious. As Jayachandran and Kremer argue, this would preserve legitimate lending by ensuring creditors that they would be punished only if they knowingly lent to a regime that acted against the interests of its population, where "knowingly" would be precisely defined by the pronouncement of the international body.

I model the loan-sanctions regime as removing all penalties for default (by successor governments) on debt contracted by regimes declared to be odious by a suitable international body. This is the most optimistic assumption about the impact of the policy, because in reality it is questionable whether an odious debt framework would entirely remove the reputational and legal penalties of defaulting (see Dömeland, Gil Sander, and Braga 2009).

As Choi and Posner (2007) note, the probability of default under the loan-sanctions framework depends on whether the odious regime is replaced. As long as the regime remains in power, it will not be eligible for debt forgiveness (in terms of the model, punishment P would still be imposed) and will therefore have to continue to repay its debt. I assume that odious regimes are replaced by nonodious ones with probability $1-q$. Recall that $(1-p_D)(1+i)d + p_D R = (1+j)d$. For $R = j = 0$ and $p_D = 1-q$, yielding $i = \left(\frac{1-q}{q}\right)$

Under this policy, governments choosing repression can borrow only $d = qD < D$, where D is the repayment amount compatible with the enforcement mechanism. This applies only to governments declared odious, which I assume are limited to those using repression.

Rewriting the incentive-compatibility constraint for this case results in

$$\left(\frac{1-p}{q-p}\right)G + \left(\frac{1-q}{q-p}\right)p(\theta-1)I + \left(\frac{1-2q+qp}{q-p}\right)D - b_1 = w^*_{1,LS}. \quad (3.9)$$

Proposition 3 summarizes the comparison between the cutoff levels of w given by the loan-sanctions framework relative to the baseline scenarios discussed earlier.

Proposition 3. *Under the loan-sanctions framework, the welfare of the population increases relative to the baseline scenario in countries in which the government has* $w < w^*_{1,LS}$, *where* $w^*_{1,LS} = \left(\frac{1-p}{q-p}\right)G + \left(\frac{1-q}{q-p}\right)p(\theta-1)I + \left(\frac{1}{q-p}\right)\big(D - d - (Dq - dp)\big) - b_1 > w^*_1$; *welfare is unchanged in countries in which* $w > w^*_{1,LS}$ *and* $d + b_1 - G > I$ *or* $D + b_1 - G < I$; *and welfare is reduced when* $w > w^*_{1,LS}$ *and* $d + b_1 - G < I$ *but* $D + b_1 - G > I$.

Under the loan-sanctions policy, countries with governments of type $w < w^*_{1,LS}$ benefit because the government chooses to switch from using repression to investing, or if it was already investing, the threat of using repression is reduced, allowing voters to demand lower rents for the government; this is true whether or not the government can afford to engage in both repression and investment. Governments of type $w > w^*_{1,LS}$ use repression. If $d + b_1 - G > I$, the government also continues to invest; the impact of the loan sanctions on the population is therefore neutral. In cases in

which $D + b_1 - G > I$ but $d + b_1 - G < I$ and $w > w^*_{1,LS}$, the population is worse off, because the government continues to use repression but now chooses not to invest.

Ex Post Framework (Debt Audits)

Under an ex post framework, international laws would be changed to allow governments succeeding odious regimes to challenge (through litigation) debt contracted by odious regimes. Unlike the ex ante framework, lenders would not be sure which governments would later be found odious, even if they were aware that there was a high probability that a regime would later be considered as such. Even regimes that lenders may strongly believe are nonodious may later be regarded as odious. For example, Jayachandran and Kremer (2006) suggest that Trudjman's Croatia could be considered an odious regime, although many Croatians consider Trudjman a national hero.

The ex post framework is modeled by assuming that creditors cannot observe whether governments engage in repression but rather observe a signal $\omega = \{0, G\}$ such that $\Pr[g = 0|\omega = 0] = s$. For simplicity, assume that $\Pr[g = G|\omega = G] = s$. In this case, default occurs if both (a) the regime is eventually found to be odious through the litigation process, which occurs with probability s if the signal was G and $(1 - s)$ if the signal was 0; and (b) the dictator is out of power in the repayment period, which occurs with probability $1 - q$. To keep things simple, I assume that governments that choose to engage in repression know they will be sending a signal $\omega = G$ with probability s, so that $\Pr[\omega = G|g = G] = \Pr[\omega = 0|g = 0] = s$.

Given that the lender observes $\omega = G$, the probability of default is $s(1-q)$ and $d^o = D(1-(1-q)s)$. If the lender observes $\omega = 0$, the probability of default is $d^n = D\big(q + s(1-q)\big)$. Therefore, if s is close to 1 (that is, there is a high correlation between the use of repression and its signal), $d^n \approx D$, whereas if s is close to $\frac{1}{2}$, $d^o \approx d^n$.

Proposition 4 summarizes the equilibrium under a debt-audit framework in international debt markets and compares the welfare implications with those of the baseline case.

Proposition 4. *Under the debt-audit framework, the welfare of the population increases relative to the baseline scenario in countries in which the government is of type* $w < w^*_{1,DA}$, *where*

$$w^*_{1,DA} = \left(\frac{1-p}{q-p}\right)G + \left(\frac{(1-q)p(\theta-1)I}{q-p}\right) + \left(\frac{(1-p)(1-q)}{q-p}\right)(2s-1)D - d^n - b_1 > w^*_1;$$

is unchanged in countries in which $w > w^*_{1,DA}$ *and* $d^o + b_1 - G > I$; *and is reduced in countries in which* $w > w^*_{1,DA}$ *and* $d^o + b_1 - G < I$. *These results require that the signal of whether a regime is odious be informative—namely,* $s > \left(\frac{1-q}{2-q-p}\right)$, *which is satisfied for* $s > \frac{1}{2}$. *Increases in s increase welfare, and as* $s \to 1$, *the debt-audit framework converges to the loan-sanctions framework. Therefore, the debt-audit framework is dominated by the loan-sanctions framework for all* $s < 1$.

The loan-sanctions framework dominates the ex post debt-audit framework in at least two ways. First, for $s < 1$, $w^*_{LS} > w^*_{DA}$, implying that any given type w that does not choose repression under the loan-sanctions framework will also not choose

repression under the debt-audit framework; the converse is not true. Second, for countries in which $D + b_1 > I$ but $d^n + b_1 < I$, the debt-audit framework, but not the loan-sanctions framework, leads to a decrease in welfare, because the (likely nonodious) government is no longer able to invest. Finally, although not always captured in the welfare of the population, unlike loan sanctions, the debt-audit framework implies higher borrowing costs to all nonodious regimes.

This discussion assumes that regimes rather than individual loans may be found to be odious ex post. In this model, because loan proceeds are fungible and $b_1 > G$, a loan-by-loan audit would not identify gun purchases, although such audits may identify episodes during which the government used loan proceeds for its own consumption. To be consistent with the starker definition of an odious regime as one that uses violence to repress the population, I focus on an audit of the regime.

Ex Ante Loan Certification (Responsible Lending)

The responsible lending framework requires lenders to abide by certain standards (for example, the Equator Principles) in order to ensure that loans are enforceable. Once a loan is judged to have met those standards, it cannot be repudiated on the grounds that it is illegitimate, even if the project fails or it is later discovered that the money was used illegally. Moreover, the loan cannot be repudiated if the successor government claims its predecessor regime was odious.

The implications of the responsible lending framework depend on the ex post status of loans that do not meet the standard. If such loans are regarded as legitimate and enforceable, governments and creditors would be able to effectively opt out of the

framework, in which case commercial creditors would be unlikely to adopt the regime. The second possibility would be for a loan that does not meet the standard to be unenforceable (that is, it is by default assumed by the courts to be illegitimate). A third possibility—that the legitimacy of loans not covered could be litigated—is similar but not equivalent to the ex post (debt-audit) approach. The key difference lies in the parties' advance knowledge of the legal implications of a repudiation under an ex ante but not an ex post framework.[7]

In modeling the responsible lending framework, I assume that loans that do not meet the standards of responsible lending are unenforceable and can be repudiated by any government without incurring punishment. If lenders were only required to verify that loan proceeds are not used to purchase guns in order to secure enforceability of their claims, the ultimate impact of the policy would be to raise financing costs, as governments would simply use domestic resources to buy guns (since $b_1 > G$ by assumption). This results in financing terms implicitly given by $d_{RL} = D - k$, where k is the verification cost. I therefore assume that lenders must verify that the funds are spent on the investment project (rather than used for buying guns or for the consumption of the government). I assume that lenders cannot observe the realization of θ before the investment is started. This implies that lenders will engage in some projects that are ex post inefficient.

Proposition 5. *Under the responsible lending framework, the welfare of the population increases relative to the baseline scenario in countries in which the government is of type* $w < w^*_{1,RL}$, *where*

$$w_{1,RL}^{*} = \left(\frac{(D-k+(p\theta-1)I)(1-q)+G(1-p)}{q-p}\right) - b_1 > w_1^{*} \text{ if}$$

$$k < \left(\frac{D(1-p)-(1-q)(\theta-1)pI}{1-q}\right).$$

If $w_1^{*} < w < w_{2,RL}^{*}$, *welfare increases if* $k > \left(\frac{(1-q)(1-p)}{q-p}\right)I$. *Welfare also increases in countries in which* $D - k + b_1 - G < I$ *but* $D + b_1 - G > I$ *and* $w_{2,RL}^{*} > w > w_2^{*}$. *Welfare decreases if monitoring costs are too high (when both investment and repression are precluded) or too low (when both investment and repression are possible).*

If the government was previously able to afford both repression and investment, the higher financing costs could make investment unaffordable, reverting to results of the case in which $D + b_1 - G < I$ applies. Assuming the government can still afford both repression and investment at the higher borrowing cost $D - k$, I calculate

$$w_{2,RL}^{*} = \frac{(1-p)G}{q-p} - D + k - b_1 - (p\theta - 1)I.$$

Interestingly, because now both types of governments can obtain loans, it is again the case that more budgetary resources (such as loans) lead to greater incentives to use repression to hold on to power. Therefore, higher monitoring costs, which reduce the budget, actually prevent the use of repression. This implies $w_{2,RL}^{*} > w_2^{*}$ for $k > 0$.

Although the threat of repression is lower, because the government is forced to invest even when it knows a project will fail, rent transfers to the government are generally higher:

$$\gamma_{2,RL}^{*} = \left(\frac{(w+D-k+b_1)(q-p)-(1-p)G+p(\theta-1)(1-p)I+(1-q)I}{(1-q)Ip\theta}\right) < \gamma_1^{*} \text{ if } k > \left(\frac{(1-q)(1-p)}{q-p}\right) I > 0.$$

Therefore, if $k > \left(\frac{(1-q)(1-p)}{(q-p)}\right) I$ welfare is unambiguously increased; $k > 0$ ensures that fewer governments choose repression but requires higher rents. The different effects of monitoring costs on countries able to afford both repression and investment implies that k must be within a certain range to ensure that welfare is raised relative to the baseline, namely,

$$\left(\frac{(1-q)(1-p)}{q-p}\right) I < k < \left(\frac{D(1-p)-(1-q)(\theta-1)pI}{1-q}\right).$$

Comparing $\gamma_{1,RL}^{*}$ and γ_1^{*}, I note that $\gamma_{1,RL}^{*} < \gamma_1^{*}$ if $k < \left(\frac{D(1-p)-(1-q)(\theta-1)pI}{1-q}\right)$.

This is a different condition from the one above ensuring that more countries choose to engage in investment rather than repression because of the need to compensate for the fact that governments must invest even when they know a project will be unsuccessful. In cases in which countries cannot afford to both invest and engage in repression, the responsible lending framework increases the number of governments that choose to invest. It may, however, also increase the required transfers to the government, because the government can no longer divert loan proceeds in cases in which it is known in advance that the investment financed by the loan will fail.

The incentive compatibility for investing or consuming the loan does not apply here, because I assume that once the government accepts the loan, it accepts that it will be monitored and unable to divert the proceeds to consumption. Although in principle the government would have incentives to truthfully reveal information to lenders about the prospects of the project, I preclude bargaining between the government and the lenders in this case.

The responsible lending regime is especially effective for governments that are not investing, because such governments would be unable to borrow at all if they wanted to continue to rule through repression. For governments that can afford to invest and use repression, the impact on welfare of the population is mixed. On the one hand, at any level of monitoring costs k, there is a clear effect of lowering the incentives for repression. On the other hand, by forcing governments to invest when a project may turn out to be unsuccessful, this framework requires transferring higher rents to the government.

Comparing the responsible lending with the loan-sanctions frameworks, I note that $w^*_{1,RL} > w^*_{1,LS}$ if k is sufficiently low, specifically $k < (qD - (1-q)I)(1-p)$. This is feasible (that is, $k > 0$) if $q > \frac{I}{D+I}$.

Creditor Collusion

In this model, creditors are indifferent between lending to different regimes. This characterization of debt markets is shared—and criticized—by some civil society organizations, which have called for creditor co-responsibility, suggesting that

creditors should discriminate against regimes deemed odious. The argument for an odious debt framework is often made in this context, suggesting that it would create such discrimination.

The discussion above suggests that different odious debt frameworks may have this result, albeit often at a cost to nonodious regimes as well. In this section, I modify the model to analyze how the introduction of an odious debt framework could change the incentives for collusion between creditors and odious regimes and result in a bias toward lending to odious regimes.

Suppose the exogenous probability of reelection q corresponds to the probability of $G' = G^L < D + b_1$ (that is, repression is "affordable"). If the government cannot afford sufficient repression (if $G' = G^H > D + b_1$), it is overthrown, which yields $\Pr[G = G^H] = 1 - q$. Assume that the revelation of G' takes place after the revelation of θ. Given that G^H is unaffordable by definition, a government that engages in repression chooses G^L and accepts the probability of being overthrown, exactly as before.

Given that politicians are risk neutral and creditors are always repaid, the equilibrium under the scenario without an odious debt framework is the same as in the previous discussion with loans in the amount of D, the maximum enforceable amount. In particular, creditors have no incentive to help troubled repressive regimes. Because they are already lending at the highest level given the available enforcement mechanisms, any attempt to save the odious regime by making repression affordable inevitably leads to default and losses. Alternatively, the creditor knows it will be

repaid by the next regime and therefore has no incentives to help the one being overthrown.

This modification does have implications when an odious debt framework is in place. Consider the case of an ex ante odious regime framework, and recall that creditors lend $d = qD$ to odious regimes when q cannot be affected by loan size. If creditors can make additional loans following the revelation of the cost of repression, they now have an incentive to support the odious regime and agree to obtain a partial repayment in the next period.

The zero-profit condition becomes $D - (1 - q)d^{sup} = d'$ (here $d^{sup} = G^H - D$, the supplemental, nonenforceable loan made once the cost G' is revealed). Solving for d', I obtain $d' = (2 - q)D - G^H(1 - q)$, which is greater than d (the amount lent to odious regimes under the ex ante approach) if $G^H < 2D$, and equal to d otherwise. Therefore, it is possible that by reducing the likelihood that creditors are paid if an odious regime is overthrown, the introduction of an odious debt framework could increase the incentives for creditors to lend to odious regimes that would otherwise be replaced.

Directions for Future Research and Conclusions

This chapter makes a first attempt at analyzing different proposals to address the odious debt problem. A number of extensions could be pursued. On a technical level, the model contains a number of nonlinear assumptions. Extensions to more continuous models (in the probability of project success or the required amount of investment, for example) would be useful to verify whether the conclusions are robust.

Another extension would be to separate reputational and direct punishments for default. With a more refined definition of punishment for default, the loan-sanctions framework—which seems to create the fewest distortions, because of the assumption that it would not change the cost of borrowing of nonodious regimes—may turn out to be more similar to the debt-audit regime than to the model presented in this chapter. Because odious regimes face market exclusion, higher financing costs, or both under the loan-sanctions regime, these methods for enforcing existing nonodious loans become ineffective. If reputational (or market) punishments are indeed an important reason why countries repay their debt, a regime that is declared odious has no incentive to honor debt it acquired before the declaration of odiousness (and which therefore is not eligible for "no-punishment" repudiation), because the borrower has already been excluded from credit markets. Lenders would price their loans in the expectation that a regime could be declared odious, and the analysis would be closer to that of the debt-audit framework. The extent to which this would create welfare losses or gains will be closely related to how well lenders can predict which regimes will be declared odious. Like the debt-audit framework, it would entail an increase in borrowing costs for all regime types.

It would also be useful to consider an extension to official creditors. Official creditors do not make lending decisions through nonarbitrage conditions; rather, most lending is done at concessional (that is, below market)rates. For official creditors, $(1 - p_D)(1 + i)D + p_{DV} << (1 + j)D$, with the difference financed by the budget of the official creditors, partly mitigated by their preferred creditor status. In the limited context of the model presented here, one would expect that official creditors may

respond more severely than commercial creditors. For example, in the loan-sanctions model, official creditors would be expected to stop lending to odious regimes entirely (one could argue that this is already the case with some countries). In addition, official creditors already have relatively strict policies in place requiring verification of the use of proceeds.

Although it focuses on relatively simple trade-offs, the analysis in this chapter suggests that among the different odious debt frameworks, the least promising is the ex post debt-audit framework, which is welfare dominated by the loan-sanctions framework. The relative merits of the responsible lending and loan-sanctions frameworks are ambiguous and depend on the cost of verifying that loans are used appropriately.

None of the proposed frameworks provides an unambiguous improvement in the welfare of the population, which cautions against drawing easy policy conclusions. Ambiguity on the effects of the different policy proposals emerges from the possibility of diversion of domestic resources from investment to repression and from the offsetting effects of different policy proposals on the threat of repression and the required transfer to the government. Moreover, the assumption that successor governments would not face any market punishment under an odious debt framework is a strong one, as is the assumption that a loan-sanctions framework would entirely remove the punishment imposed on a defaulting country even if it were allowed to do so.

Framing the problem as one of political agency does, however, highlight the importance of promoting effective expenditure-tracking mechanisms and budget

transparency as a means of ensuring that not only the proceeds of loans but also all public resources are used in the interests of the population rather than for the private gain of politicians in government. Indeed, in Chapter 2, I show that reducing the cost of information acquisition by voters improves their control over the government, promotes the alignment of interests between governments and their population, and reduces the incurrence of odious debt.

Annex Proofs

Proposition 1

I first write the incentive compatibility (IC) constraint that ensures the politician refrains from using repression, assuming that investing (rather than consuming the investment funds) is also incentive compatible. The constraint is given by

$$w + D + b_1 - G + qV^G < w + D + b_1 + p(\gamma\theta - 1)I + pV^B$$

or

$$qV^G - pV^B < G + p(\gamma\theta - 1)I \tag{A3.1}$$

In this expression, V^G is the continuation value for a government that chooses to purchase guns, and V^B is the continuation value for a government that chooses to invest in a butter factory. Attention is restricted to stationary equilibria, in which politicians choose the same strategies each period. Solving for $V^{G,B}$ and replacing the result in (A3.1) yields (3.7) in the text:

$$w < \left(\frac{(1-p)G+(1-q)p(\gamma\theta-1)I}{q-p}\right) - D - b_1.$$

By setting $\gamma = 1$, I define $w_1^* \equiv \left(\frac{(1-p)G+(1-q)p(\theta-1)I}{q-p}\right) - D - b_1$ as the critical level of w such that by the linearity of the inequality on γ, any government with $w > w_1^*$ will choose repression independent of γ. For $w \leq w_1^*$, voters set the optimal γ_1^* that maximizes their utility, subject to incentive compatibility for the government. Given the simple linear forms in the model, utility maximization implies minimizing the value of γ to just ensure that incentive compatibility is met.

The second incentive compatibility constraint states that the government that forgoes repression should choose to invest rather than consume when it observes that $\theta_t = \theta$. This constraint is given by $(\gamma\theta - 1)I + V^B \geq 0$, or $\gamma \geq \left(\frac{I-(w+D+b_1)}{\theta I}\right) \equiv \gamma_0$. Because $I \leq D + b_1$ (that is, the budget constraint for investment must be met), even if $w = 0$ the right-hand side of this inequality is negative. Therefore, this incentive compatibility is not binding, and voters can set γ_0 to zero.

The second incentive compatibility constraint is given by equation (3.7) in the text. Modifying it as a function of γ yields $\gamma \geq \left(\frac{(w+D+b_1)(q-p)-(1-p)G+(1-q)pI}{\theta(1-q)pI}\right) \equiv \gamma_1$. Because $\gamma \in (0,1)$ and voters will provide the smallest possible value of gamma such that the appropriate incentive compatibility condition is met, $\gamma^* \in \{0, \gamma_1^*\}$, where $\gamma_1^* = \min\{\gamma_1, 1\}$ is the lowest transfer the population must make to ensure that the politician does not choose repression.

Equation (3.7) is binding (and $\gamma_1 > 0$) when $w \geq \left(\frac{(1-p)G-(1-q)pI}{q-p}\right) - D - b_1 \equiv w_1^{\gamma=0}$. Moreover, $w_1^{\gamma=0} < w < w_1^*$, because w_1^* is monotonically increasing on γ.

Finally, I consider the optimality of cutoff rule. Given that the voting rule must rely on the observable output, that the external benefits of the investment are not observable during voters' lifetime, and that each country has a single (known) type of politician, voters cannot improve their welfare by reelecting a government that delivers zero output (except for the knife-edge case of $w = w_1^*$). For $w < w_1^*$, if voters were to reelect a government that delivers no private output from the investment (that is, for $\gamma^* = 1$), the government would have an incentive to set $\gamma = 1$ at all times, although it would still invest and not use repression at a lower level of γ. From the point of view of the government, deviation is not profitable since it is not possible to extract higher rents from the population. Since voters cannot transfer the external benefits of the investment to the government, they cannot offer rents greater than $\gamma = 1$, a level which voters are already willing to offer as long as that ensures the government does not resort to repression. On the other hand, voter welfare is also not increased if governments that deliver public services are not re-elected, as that would change the incentives of politicians towards using repression and/or demanding higher rents. Therefore, voters are at least indifferent between using the cut-off rule or another rule, implying that it is consistent with optimizing behavior.

Proposition 2

The analysis of the second case is similar to the first, except that the benefits of engaging in repression are greater, because the government can capture the full output of the investment project and incur only a probability $q < p$ of being replaced. The government must still trade off these benefits with the cost of repression.

As in the previous case, I begin by identifying the incentive compatibility constraint for avoiding repression assuming the government has the right incentives to invest:

$$w + D + b_1 - G + p(\theta - 1)I + qV^G < w + D + b_1 + p(\gamma\theta - 1)I + pV^B$$

or

$$qV^G - pV^B < G. \tag{A3.2}$$

As above, I solve for the continuation values, $V^B = \left(\frac{w+D+b_1+p(\gamma\theta-1)I}{1-p}\right)$ and $V^G = \left(\frac{w+D+b_1-G+p(\theta-1)I}{1-q}\right)$.

Replacing the continuation values above in (A3.2) yields

$$w < \left(\frac{1-p}{q-p}\right)G + \left(\frac{1-q}{q-p}\right)(\gamma\theta - 1)pI - \left(\frac{1-p}{q-p}\right)(\theta - 1)pI - D - b_1. \tag{A3.3}$$

I define w_2^*, the cutoff ego-rent above which a government will always choose to use repression regardless of the amount of rents voters allow the government to keep, in a manner similar to that used the previous case, as $\left(\frac{1-p}{q-p}\right)G - (\theta - 1)pI - D - b_1 \equiv w_2^*$.

Regardless of whether the government uses repression, the incentive compatibility condition for investing (given $\theta_t = \theta$) is the same as before:

$$\gamma \geq \left(\frac{I-(w+D+b_1)}{\theta I}\right) \tag{A3.4}$$

and still implies $\gamma^* = 0$, because now $d' + b_1 > I + G >> I$.

Rewriting (A3.3) in terms of γ yields

$$\gamma \geq \left(\frac{(w+D+b_1)(q-p)}{(1-q)pI\theta}\right) + \left(\frac{(1-p)(\theta-1)+1-q}{(1-q)pI\theta}\right)pI - \left(\frac{(1-p)}{(1-q)\theta}\right)\left(\frac{G}{pI}\right) \equiv \gamma_2.$$

Therefore, as in Baseline Case 1, there are two cutoffs for w that give rise to three regions of w: (a) $w > w_2^*$ (repression is always chosen); (b) $w^* \geq w > w_2^{\gamma=0}$ (A3.3 is binding and $\gamma^* > 0$); and (c) $w \leq w_2^{\gamma=0}$ ($\gamma^* = 0$), where $w_2^{\gamma=0}$ is the cutoff at which $\gamma^* > 0$ and is given by $\left(\frac{1-p}{q-p}\right)(G - \theta pI) - D - b_1$.

The argument for the optimality of the retrospective voting rule is similar to that used in the previous case, as the government would have an incentive to deviate from any voting rule if it could be reelected despite delivering no output.

Proposition 3

I begin by analyzing the effects of $d < D$ on w_1^*. In this case, because $d' + b_1 - G < I$, reducing $d' = d < D$ for regimes choosing repression implies that Baseline Case 1 applies (the government cannot afford to both invest and use repression). Rewriting the incentive compatibility constraint for this case results in

$$\left(\frac{1-p}{q-p}\right)G + \left(\frac{1-q}{q-p}\right)p(\theta - 1)I + \left(\frac{(1-2q+qp)}{q-p}\right)D - b_1 = w_{1,LS}^*$$

Comparing $w_{1,LS}^*$ with w_1^*, $q < 1$ implies that $w_{1,LS}^* > w_1^*$. Therefore, some government types that previously would have chosen repression now choose to invest.

As before, $\gamma_0 = 0$ and $\gamma_{1,LS} = \left(\frac{(b_1+w)(q-p)-(1-p)G}{(1-q)\theta pI}\right) - \left(\frac{(D-d-(Dq-dp))}{(1-q)\theta pI}\right) + \left(\frac{1}{\theta}\right) < \gamma_1$. Therefore, with the threat of repression reduced, the equilibrium level of rents also decreases.

For governments that previously could afford both investment and repression ($D + b_1 - G > I$), two outcomes are possible. If $d + b_1 - G < I$, the analysis is as in

Baseline Case 1. Because $w^*_{1,LS} > w^*_1 > w^*_2$, government types between $w^*_{1,LS}$ and w^*_2, which would previously have chosen repression (and investment), now choose to invest only. However, governments with type $w > w^*_{1,LS}$ now cease to invest and continue to undertake repression, reducing overall welfare.

For countries in which $b_1 + d - G > I$, the incentive compatibility constraint for not using repression and the critical value $w^*_{2,LS}$ are given by:

$$w < \left(\frac{1-p}{q-p}\right)G + \left(\frac{(\gamma\theta - 1)(1-q) - (\theta-1)(1-p)}{q-p}\right)pI + \left(\frac{(1-p)(D-d)}{q-p}\right) - D - b_1$$

$$w^*_{2,LS} = \left(\frac{1-p}{q-p}\right)G - (\theta-1)pI - D - b_1 + \left(\frac{(1-p)(D-d)}{q-p}\right)$$

Because $w^*_{2,LS} > w^*_2$ by the last term, the impact of the loan-sanctions regime is to reduce the incentives for using repression as a tool.

Finally, I derive $\gamma_{2,LS} = \left(\frac{(q-p)(w+D+b_1)-(1-p)G-(1-p)(D-d)+(\theta-1)(1-p)pI+(1-q)pI}{(1-q)pI\theta}\right) < \gamma_2 \left(\gamma_2 - \gamma_{2,LS} = \left(\frac{(1-p)(D-d)}{(1-q)pI\theta}\right)\right)$. This demonstrates that, as expected, rents are reduced along with the threat of repression.

Proposition 4

I begin by analyzing the effects of $d^{o,n} < D$ on w^*_1. In this case, because $D' + b_1 - G < I$, reducing $D' = d^{o,n} < D$ for regimes choosing repression implies that Baseline Case 1 applies (the government cannot afford to both invest and use repression). Rewriting the incentive compatibility constraint for this case results in $w < \left(\frac{1-p}{q-p}\right)G +$

$\left(\frac{(1-q)p(\gamma\theta-1)I}{q-p}\right)+\left(\frac{1-p}{q-p}\right)(d^n-d^o)-d^n-b_1$. This inequality corresponds to $w^*_{1,DA}=\left(\frac{1-p}{q-p}\right)G+\left(\frac{(1-q)p(\theta-1)I}{q-p}\right)+\left(\frac{1-p}{q-p}\right)(d^n-d^o)-d^n-b_1$. Replacing (d^n-d^o) with the definition of the two debt levels, I obtain $w^*_{1,DA}=\left(\frac{1-p}{q-p}\right)G+\left(\frac{(1-q)p(\theta-1)I}{q-p}\right)+\left(\frac{(1-p)(1-q)}{q-p}\right)(2s-1)D-d^n-b_1$, which is monotonically increasing in s.

When $s=1$, $w^*_{1,DA}=\left(\frac{1-p}{q-p}\right)G+\left(\frac{(1-q)p(\theta-1)I}{q-p}\right)+\left(\frac{pq-2q+1}{q-p}\right)D-b_1=w^*_{1,LS}$.

Comparing $w^*_{1,DA}$ with w^*_1, $w^*_{1,DA}>w^*_1$. This requires $(D-d^n)q+(d^n-d^o)>(D-d^o)p$, or, expressed as a condition on the quality of the signal, $s>\left(\frac{1-q}{2-q-p}\right)$, which is true as long as the signal is informative $(s>\frac{1}{2})$.

Because in Baseline Case 1 investment precludes repression, $\gamma_0=0$ and $\gamma_{1,DA}=\left(\frac{(w+d^n+b_1)(q-p)-(1-p)G-(1-p)(d^n-d^o)+(1-q)pI}{(1-q)pI\theta}\right)<\gamma_1$ if $s>\left(\frac{1-q}{2-q-p}\right)$. Thus as above, as long as the signal is informative, the threat of repression is decreased. The debt-audit policy also creates the possibility that $d^n+b_1<I$, which decreases voter welfare under the model as the government must resort to repression.

For governments that previously could afford both investment and repression $(D+b_1-G>I)$, two outcomes are possible. If $d^o+b_1-G<I$, the analysis is as in Baseline Case 1. Depending on the quality of the signal, some types of governments that had engaged in repression start investing and others stop investing and continue to use repression. If the signal is not informative, more government types choose repression.

For countries in which $b_1 + d^o - G > I$, I derive the incentive compatibility for not using repression and the critical value $w^*_{2,DA}$:

$$w < \left(\frac{1-p}{q-p}\right) G + \left(\frac{(\gamma\theta - 1)(1-q) - (\theta - 1)(1-p)}{q-p}\right) pI + \left(\frac{(1-p)(d^n - d^o)}{q-p}\right) - d^n - b_1$$

$$w^*_{2,DA} = \left(\frac{1-p}{q-p}\right) G - (\theta - 1)pI - d^n - b_1 + \left(\frac{(1-p)(d^n - d^o)}{q-p}\right).$$

I can show that $w^*_{2,DA} > w^*_2$, because $(D - d^n)(q - p) + (1 - p)(d^n - d^o) > 0$. Therefore, the debt-audit regime also reduces the incentives for using repression for governments that invest.

Finally, I derive $\gamma_{2,DA} = \left(\frac{(w + d^n + b_1)(q-p) - (1-p)G - (1-p)(d^n - d^o) + pI(\theta - 1)(1-p) + pI(1-q)}{pI(1-q)\theta}\right) < \gamma_2$ $(\gamma_2 - \gamma_{2,DA} = \left(\frac{(d^n - d^o) - (D - d^o)p + (D - d^n)q}{p\theta I(1-q)}\right)$, which was shown to be greater than zero as long as the signal is informative).

Proposition 5

For the case in which $d' + b_1 - G < I$, no loans are available to regimes that choose to use repression (because investment is not affordable), and the incentive compatibility condition becomes

$$w + b_1 - G + qV^G < w + D - k + b_1 + (p\gamma\theta - 1)I + pV^B.$$

In addition, now the government that invests must pay the monitoring cost k and cannot consume I if $\theta_t = 0$. Therefore the cost I must be paid with probability 1.

Replacing V^B and V^G yields $w < \left(\frac{(D-k+(p\gamma\theta-1)I)(1-q)+G(1-p)}{q-p}\right) - b_1$. I derive $w^*_{1,RL}$ as before: $w^*_{1,RL} \equiv \left(\frac{(D-k+(p\theta-1)I)(1-q)+G(1-p)}{q-p}\right) - b_1$. Note that $w^*_{1,RL} > w^*_1$ if k is sufficiently low, namely, if $k < (1-p)\left(\left(\frac{D}{1-q}\right) - I\right)$.

For $w \leq w^*_{1,RL}$, the optimal $\gamma^*_{1,RL}$ that maximizes voter utility subject to incentive compatibility for the government is given by $\gamma^*_{1,RL} = \left(\frac{(w+b_1)(q-p)-G(1-p)-(D-k)(1-q)+(1-q)Ip\theta}{(1-q)Ip\theta}\right)$. The critical value of w above which $\gamma\_(1, RL) > 0$ is given by $w^{\gamma=0}_{1,LR} = \left(\frac{(1-p)G-(1-q)Ip\theta+(D-k)(1-q)}{q-p}\right) - b_1 > w^{\gamma=0}_1$, if $k < \left(\frac{D(1-p)-(1-q)(\theta-1)pI}{1-q}\right)$. If $\theta > \left(\frac{1}{p}\right)$, $(1-p)\left(\left(\frac{D}{1-q}\right) - I\right) > \left(\frac{D(1-p)-(1-q)(\theta-1)pI}{1-q}\right)$. Therefore, if $k < \left(\frac{D(1-p)-(1-q)(\theta-1)pI}{1-q}\right)$, welfare is unambiguously increased; if $\left(\frac{D(1-p)-(1-q)(\theta-1)pI}{1-q}\right) < k < (1-p)\left(\left(\frac{D}{1-q}\right) - I\right)$, governments are more likely to invest, but required rents increase.

Notes

1. This chapter also appears as Chapter 10 in *Debt Relief and Beyond: Lessons Learned and Challenges Ahead*, edited by Carlos A. Primo Braga and Dörte Dömeland, pages 229-260.
2. Creditors seized railroads in Chile and Costa Rica in the late 19th century.
3. Tomz (2007) argues that even prominent historical examples of this type of enforcement may overstate its role.
4. In both cases, there is a possibility that all cash flows can be misappropriated, including those coming from loans.

5. See Besley (2004) for a discussion of the impact of wages of politicians in a political agency model.
6. I assume that loans do not pay interest but instead are sold at a discount (that is, the proceeds are less than the repayment obligation) that provides the appropriate returns.
7. Although it is left for further research to analyze this third case, the fact that only loans outside the framework can be litigated provides certainty to creditors who do abide by it and is not exactly equivalent to the debt-audit case, in which a lender observing a signal $\omega = 0$ may still be challenged in court.

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4

Debt, Institutional Change, and Sustained Growth

I wish to investigate the links between debt distress, economic growth and the quality of policies and institutions. Kraay and Nehru (2006—henceforth KN) offer compelling evidence that economic policies and institutions—as measured by the World Bank's Country Policy and Institutional Assessment (CPIA)—are robust predictors of episodes of debt distress. Meanwhile, a large empirical literature claims that policies and institutions play a causal role in promoting long-term economic growth, which in turn would also be expected to influence the probability of debt crises. The primary goal of this chapter is to link these two literatures by investigating the possibility that institutions influence the sustainability of public debt both directly but also through their effect in long-term economic growth.

I find that a country experiencing sustained economic growth faces a lower probability of debt distress, and that improvements in policies and institutions, as measured by the changes in the CPIA, are robust predictors of sustained economic growth. These findings underlie the argument that there are two important channels through which institutions affect debt sustainability: independently, and through their role in promoting economic growth.

Debt, growth and institutions are related in multiple directions, and therefore I pay particular attention to problems of reverse causation. For example, the relationship between slow growth and debt distress could be driven by the fact that high debt leads both to debt distress and to low growth—through a debt overhang effect (Krugman 1988), or by hindering the ability of governments to make investments with potential growth externalities (such as education or infrastructure) because of liquidity constraints. I do not find evidence to support those hypotheses; rather, some evidence suggests that countries acquire high debt levels (as a percentage of gross domestic product) as a consequence of low growth.

The second reverse causation concern relates to the relationship between growth and institutions. While there is clearly a strong correlation between growth outcomes and various measures of the quality of institutions, the debate around the direction of causation has not been resolved (Glaeser et al., 2004). While this chapter does not purport to settle the debate, it does try to address the reverse causation issue through the use of both standard panel data techniques as well as a technique that considers whether changes in the measured quality of institutions may increase the probability of countries entering a sustained growth episode. Specifically, I identify sustained and unsustained growth episodes that are very similar at the outset, particularly as it relates to recent growth, which precludes identification if the independent variables are simply growth correlates (a common and justified concern with variables that attempt to measure institutional quality). I further substantiate these findings by applying panel data techniques to all available data, including system GMM that explicitly addresses endogeneity in explanatory variables. Regardless of the

approach used, I find that improvements in institutions are generally significant predictors of future growth. This suggests that the policies and institutions measured by the CPIA may have a causal impact on growth, or at least that the economists that prepare these measures are able to identify factors that precede sustained economic growth. Although concerns about serial correlation remain, the clear separation in time between (forward looking) growth episodes and changes in institutions that take place before the beginning of the onset of the episode provides some evidence to the direction of causation.

While the use of growth episodes turns out to be useful for technical reasons, the motivation is supported by intuition. Exogenous shocks (measured as lower growth rates in a given year) have been shown to predict episodes of debt distress (Kraay and Nehru 2006), but the hypothesis of interest in this chapter is whether long-term growth—which is in turn postulated to be linked to the quality of institutions—impacts the probability of debt distress. An exogenous shock may lead to a liquidity crisis if an otherwise solvent country is unable to roll-over its debts, but it is long-term growth that determines solvency. Growth episodes are useful because they are highly correlated to long-term growth, but, by design, uncorrelated to short-term growth.

Two main conclusions emerge from the analysis. The first is a refinement of Kraay and Nehru (2006): policies and institutions seem to influence the probability of debt distress directly, but they are also important through their role in promoting sustained economic growth. On a theoretical level, one could think of the two channels as two types of constraints that affect the probability a country will default: the former arises from strategic interactions (incentive-compatibility constraints that

are relaxed when institutions are better), while the latter represents resource (or budget) constraints (which are relaxed when growth is high). This framework to think of the role of institutions in debt sustainability parallels the concepts of "ability" and "willingness" to pay used in financial markets to assess how risky a country's debt securities are: a country's "ability to pay" refers to resource constraints, while its "willingness to pay" is related to the outcome of strategic interactions.

The second conclusion is a refinement of existing empirical analysis on the relationship between growth and institutions. So far, that literature has focused primarily on investigating the relationship between levels of institutional variables and long-term growth, whereas I am able to demonstrate that changes in institutions and policies may be possible and have a positive growth effect. This is an important distinction, since it shows that even (relatively) small improvements in policies and institutions (of the type likely to be captured by the changes in CPIA scores) can actually have important positive effects in terms of economic growth.

The remainder of this chapter is organized as follows: the next section discusses the literature on debt and growth and provides a very brief discussion on the large body of literature on growth and institutions. I then describe the estimation strategy, and next discuss the key variables used. The results are presented, followed by some robustness checks. The final section concludes and offers suggestions for further research.

Relation to the Literature

In addition to KN, other authors have investigated the empirical relationship between institutions and debt distress. Manasse, Roubini and Schimmelpfennig (2003) and Manasse and Roubini (2005) find that political uncertainty is a good predictor of sovereign debt crises. Reinhart, Rogoff, and Savastano (2003) note that some countries display "debt intolerance," suggesting that there are institutions in those countries that make default more likely regardless of fiscal conditions. Brewer and Rivoli (1990) consider whether democratic institutions are more or less likely to default, but don't find a statistically significant relationship. Except for KN, papers looking at the link between institutions and debt tend to focus only on middle-income countries, while I include both low and middle-income countries.

The relationship between growth and debt sustainability is well-known, although the focus has usually been on contemporaneous or recent growth (which may pick up shocks related to the business cycle) rather than sustained long-term growth. Among the many studies of default risk which find that (contemporaneous) growth affects the probability of debt distress, one can mention McFadden, et al. (1985), Taffler and Abassi (1987), Savvides (1991), and Kraay and Nehru (2006). Although contemporaneous GDP growth provides an adequate measure of exogenous shocks (and therefore of defaults caused by liquidity shortages), it is not necessarily a good indicator of ability to pay, which is more likely driven by long-term growth.

The connection between growth and institutions has been the subject of extensive empirical research, starting with Knack and Keefer (1995), and most recently with contributions by Acemoglu, Jones and Robinson (2002), Rodrik,

Subramanian and Trebbi (2004), Persson (2005) and Glaeser, et al. (2004). Most recent empirical work on the relationship between institutions and economic growth has used an instrumental variables approach to address the endogeneity problem. One particular instrument, used initially by Acemoglu, Jones and Robinson (2002), the death rate of colonial settlers, has proven quite robust. Although the debate is not settled, the balance of the evidence supports the argument that institutions are an important determinant of economic growth.

A common characteristic of this literature is the view that institutions should be relatively unchanged over time. Glaeser et al. (2004) argue that institutions, as distinguished from institutional outcomes, should: i) reflect constraints; and ii) be relatively permanent (in contrast, measures of institutional outcomes tend to rise with income and be very volatile). In this chapter I take a different point of view, which is in part due to the institutional measure I use. The changes in the CPIA are at least partly exogenous (from a country's "deeper" institutions) since countries benefit from CPIA improvements through larger allocations from the International Development Association (IDA)[1], which creates an outside incentive for institutional change. Moreover, measurable institutional outcomes may actually represent or lead to changes in the institutions themselves. Trade liberalization is one example, being both a product of certain internal and external political conditions, but also changing the incentives of political actors once it is implemented. I considered the possibility that income is correlated with the institutional variable, but find that changes in the CPIA provide information on future growth even after such endogeneity is taken into account.

A paper that takes a similar episodic approach to long term growth is Hausmann, Rodrik and Velasco (2005). The authors study the determinants of growth accelerations; as the name "accelerations" suggests, the authors are primarily concerned with an increase in the rate of economic growth. While the approach of this chapter also implies a growth acceleration (by definition, the growth rate must accelerate to over 4% for a country to enter a growth episode), I am primarily concerned with the persistence of that initial acceleration, and less with the magnitude of the acceleration. The main reason for the different approaches relates to the applicability to debt sustainability: the relevant characteristic of growth for the purposes of this chapter is its sustainability rather than acceleration. Moreover, a notable contrast between the analysis here and that of growth episodes in Hausmann et al. is that I find that the episodes can be predicted by changes in the CPIA, as well as other variables that have appeared elsewhere in the literature to predict economic growth (such as education and the form of democracy), while Hausmann et al. generally find that accelerations are difficult to predict.

A Simple Model of Institutions, Debt and Growth

To motivate the empirical analysis to follow, consider a simple model. There are two actors in the economy: a government and a representative voter. There are two production technologies available to this economy, both of which require a minimum investment that exceeds the country's own resources, which I assume to be zero. Therefore, the investment requires foreign borrowing. The two production technologies have the form $y_{A,B} = d\theta_t = p + x$, where d is the amount required for

investment, which is equal to the loan the country must contract from foreign creditors and θ_t are stochastic i.i.d. returns. The gross returns to the project, $d\theta_t$, are divided between private returns p, which can be appropriated by the government, and external returns x, which cannot. For example, the investment project could be the construction of a toll road between the capital city and the country's port; the government can appropriate the toll revenues, but not the resulting benefits from greater trade that the road will generate. Technology A has higher expected overall output ($y_A > y_B$), but lower expected private returns, whereas technology B has higher private returns but lower expected overall output. I model these production technologies as follows:

$$E[y_A] = qx + (1-q)p \tag{4.1}$$

$$E[y_B] = (1-q)x + qp \tag{4.2}$$

where $\frac{2}{3} > q > \frac{1}{2}$, and $x > p$, which ensures that $E[y_A] > E[y_B]$.[2]

The utility of the government is given simply by $u_G = \gamma p$, where γ represents the fraction of the private output that the government can appropriate. The utility of the voter is given by $u_V = (1-\gamma)p + x - D$, where D is the repayment amount of debt, which may be more than the borrowed amount d depending on world interest rates and the probability of default.

There are three periods, and governments are up for election at the end of the first and second periods. The investment project yields output in periods 1 and 3, but the technology is fixed from period 1. Only the overall output, but not the technology, is known to voters at the time of the election at the end of period 1. Voters use a

retrospective voting rule, retaining the government if the utility is above a certain cut-off level. Governments appropriate all private output, if any, in the last period (subject to being in power).

In the second period, the country must make a partial debt repayment, which I assume is stochastic and observable only to the government. This can be interpreted as an economic shock, which reduces the amount available for debt service payments. The key is that the voters cannot observe the resources available to or needed by the government for the debt service payment. Elections take place after the payment is made (or the country goes into default). Default incurs a punishment, which affects both voters and governments. The payment is given by: $m = \omega p$, where $\omega \sim U(0,1)$ is the fraction of private output that needs to be paid. In the third period, the country only pays $D - m$. Finally, the economy is subject to another stochastic shock $\nu \sim U(0,1)$ in the third period, prior to debt repayment, such that the output available for debt repayment is $E[y]\nu$. The probability of default is therefore $\Pr[E[y]\nu < D] = Pr\left[\nu > \frac{E[y]}{D-m}\right]$.

The quality of the country's institutions is modeled in the same spirit as in Chapter 2 as the cost of observing the government's actions (in this case, which technology is chosen). To keep the model simple, I assume that only two institutional settings are possible: full information and no information (that is, k large and $k = 0$).

Consider a government that begins with "bad institutions" where k is too high for voters to use. The equilibrium of the voting game for this institutional setting is given by Proposition 1:

Proposition 1. *When voters cannot observe the technology adopted, technology B is always chosen and voters re-elect governments that provide a minimum utility of* $(1-\gamma)p = qp$. *The government extracts this entire amount at the time of partial debt repayment (period 2). Finally, the probability of default in the final period is given by* $Pr\left[\nu > \frac{2(1-q)x}{D-m}\right]$.

Proof: See appendix.

Voters cannot offer rents that are sufficiently high to induce the use of technology A because when governments are "unlucky" (that is, there are no private returns), they are re-elected by virtue of $x > p$ and the fact that the external returns cannot be appropriated. This implies that both technologies provide the same expected returns when the external output is realized in the first period. When the private return is realized in the first period, the government is even willing to provide a higher fraction of output when it uses technology B because the probability of obtaining private returns in the second period is higher. The resulting expected output is given by $2(1-q)x + q(1-q)p$.

Voters wish to avoid default, and are willing to transfer the entire surplus back to the government and re-elect it in the next election. The government will repay the debt and keep the surplus, get re-elected, and collect expected returns of qp in the third and last period. In the final period, default occurs if resources are not sufficient for repayment.

Now consider the impact of lowering the cost of observing the government's actions (which I take to represent an improvement in institutions), in this case all the

way to zero. This applies both to the use of the technology as well as the costs of debt service repayment. The voter can now re-elect the government only if it implements technology A, and fire the government if it chooses technology B. It can also set a voting rule not on default but on the actual repayment amount. Proposition 2 summarizes the results for this case:

Proposition 2. *When voters can costlessly observe the actions of the government, technology A is always chosen and the minimum utility cut-off is given by* $(1-\gamma)p = (1-q)p$ *for* $q < 0.62$ *and* $(1-\gamma)p = \frac{2-3q}{1-q}p$ *for* $0.67 > q \geq 0.62$. *The probability of default in the final period is given by* $Pr\left[v > \frac{2qx+(1-q)(p-m)}{D-m}\right]$, *which is lower than before.*

Proof. See appendix.

The key change, clearly, is the fact that the government still benefits from re-election, but this is now only possible through the use of technology A. The resulting expected output is given by $2qx + (1-q)\gamma p$. For $q < 0.62$, this implies $E[y] = 2qx + (1-q)q(p-m) > 2(1-q)x$.

Therefore, the simple model in this section illustrates how the quality of institutions, modeled here as the cost of observing the actions of the government ("k"), influences the probability of default in two ways: first, k impacts the choice of investment technology, and therefore of growth in the economy. If the government invests in the technology with higher returns, the country is less likely to find itself unable to repay the loan; second, k impacts the level of transfers to the government, which has an independent impact on the probability of default by reducing the

amount available to repay the loan (though not necessarily the amount available in the economy). The second case, therefore, is one of "unwillingness"—rather than "inability"—to repay, since the resources are available but have been misdirected. To summarize, an improvement (deterioration) in institutions leads to higher (lower) growth, which in turn makes default less (more) likely, while at the same time directly reducing (increasing) the probability of default. I proceed to test the hypothesis illustrated by this simple model.

Estimation Strategy

I undertake two strategies for estimating the effects of institutions on sustained economic growth and on the probability of debt distress. The preferred strategy relies on identifying sustained growth episodes, which are described in detail below. The first step under this approach involves testing whether the probability of having an episode of debt distress is lower following a year during which the country is experiencing a sustained growth episode. I perform that step by running probit regressions on a modified version of KN's main estimation equations as follows:

$$\Pr(\text{distress}_{it} = 1) = \Phi[\alpha + \beta_1 \text{CPIA}_{i,t-1} + \beta_2 \text{Debt}_{i,t-1} + \beta_3 \text{Shocks}_{i,t-1} + \beta_4 \text{GrowthYear}_{i,t-1} + u_{i,t-1}] \quad (4.3)$$

The second step involves estimating the probability that a country will enter an episode of sustained growth given a change in its CPIA rating. I perform a similar probit analysis of the growth episode variable, as described by:

$$\Pr(\text{growth episode}_{i,t=1}) = \Phi[\alpha + \beta_1 \Delta CPIA_{i;t,t-1} + \beta_2 x_{i,t-1} + u_{i,t-1}] \quad (4.4)$$

where $x_{i,t-1}$ are control variables. The coefficient β_1 in Equation (4.2) above would be meaningless if both changes in the CPIA and growth episodes are being caused by contemporary growth (that is, if growth is persistent), a plausible omitted variable concern. However, the growth episode variable is designed specifically to exclude that possibility, so that the coefficient on the change in CPIA would only be significant if the CPIA contains more information than simply a country's recent growth experience.

I note the distinction between the approach of this chapter and the traditional instrumental variables approach used in other studies of institutions and growth. In both cases, there is a concern that an omitted variable is driving both growth and institutions, or, similarly, that it is growth that causes better institutions (reverse causation). The usual approach is to find an instrument for institutions: settler mortality during colonial times cannot be caused by 20th century growth, but can plausibly cause 20th century institutions if institutions are sufficiently persistent.

Loosely speaking, the approach here is to find an "instrument" for growth: growth episodes, by design, are not caused by previous growth, but they are causally related to long-term growth in an obvious way. Since growth episodes are not caused by previous growth, they cannot be caused by institutional measures that only contain information about previous growth. Therefore, although to a large extent institutional measures are indeed caused by previous growth, they must contain additional information if they are to predict episodes that are characterized by similar initial conditions.

In addition, while the use of suitable instruments for institutions might be helpful, it is not without its limitations. It would be difficult to find an instrument that would still allow us to look at changes in institutions; existing instruments such as latitude, settler mortality and ethnic fractionalization cannot capture the possibility of institutional change. Moreover, even well-known instruments are subject to criticism. Glaeser et al. (2004) argues that settler mortality is also an instrument for human capital. Settlers brought both institutions and human capital with them; where they died in greater numbers the original stock of human capital was smaller, and thus growth was constrained. Any growth model showing dependence on initial conditions would then not be able to distinguish between growth led by human capital, where institutions arise as a consequence of such growth, and one where institutions cause economic growth, which then allows the country to accumulate human capital.

The second strategy involves using panel data techniques to study the effect of institutions on growth in five-year windows. The five-year window, which is standard in the literature, is long enough to allow exogenous shocks to dissipate but short enough to maximize the amount of data available. The windows begin in 1978, the first year for which changes in the CPIA are available. I present the results of the panel regressions alongside the results of the analysis of growth episodes.

Under this second strategy, the first step involves replacing $\text{GrowthYear}_{i,t-1}$ in Equation (4.3) with GDP growth in the previous five years. I then proceed by using panel data methods (OLS, fixed-effects, random effects and system GMM) to estimate the following equation, based on Bond, Hoeffler and Temple (2001):

$$\Delta y_{i,t} = \gamma_t + y_{i,t-5} + \beta_1 x'_{i,t-5} + \beta_2 \Delta CPIA_{i;t-5,t-6} + v_i + e_{i,t} \quad (4.5)$$

where γ_t are time dummies, y_i, are logs of GDP per capita, $x'_{i,t-5}$ are controls, and v_i are country-specific effects.

The fixed-effects estimator (or "Least Squares with Dummy Variables", LSDV) has been used in the earliest panel analysis of economic growth, such as Islam (1995). Because growth regressions include a lagged dependent variable, however, the LSDV estimator is biased. The bias goes to zero as $T \to \infty$, but it is still substantial in finite samples with T as large as 30 (Judson and Owen 1997). The random-effects estimator is unbiased, though it is usually rejected in growth empirics because the error term is correlated with omitted country-specific errors. If most relevant country-specific effects can be captured by the country's initial income, however, the random-effects estimator could be consistent when v_i is replaced with income in 1977 as a proxy for country-specific effects (although consistency would also depend on whether the explanatory variables are exogenous, which is a strong assumption).

Most recent empirical studies of economic growth rely on system-GMM methods developed by Arellano and Bover (1995) and Blundell and Bond (1998). The system-GMM estimator combines equations in first-differences that use lagged-levels as instruments with equations in levels with first-differences as instruments. To allow lagged first-differences to be used as instruments in level equations, the model requires that growth rates not be correlated with the country-specific effects ($E(v_i \Delta y_{it}) = 0$). This assumption is satisfied if the means of the GDP series are stationary, which is only the case when time dummies are included and essentially transform the GDP series into deviations from yearly means (that is, the mean of GDP growth in a given

year across all countries).[3] Thus the inclusion of time-effects, which is equivalent to the assumption of common technical progress, is not optional in system-GMM. One major advantage of system GMM is that it allows for endogeneity in explanatory variables provided that their first-difference is uncorrelated with the country-specific effects (that is, $E(v_i \Delta x_{it}) = 0$) (Bond, Hoeffler and Temple 2001).

Although the panel data analysis approach is more common in the literature, Pritchett (2000) gives four reasons to question its use in the study of economic growth: lower power, greater measurement error, endogeneity, and dynamic misspecification. Pritchett points out that growth correlates are relatively persistent over time, while growth rates are volatile; this leads a fixed-effects model to attribute most of the variation in growth rates to its volatile components (since the persistent effects are captured by the fixed-effects or eliminated by first-differencing), which are usually due to shocks rather than fundamental causes.

Pritchett also argues that fixed effects increase the attenuation bias from the measurement error of those persistent variables, since the cross-sectional variance is large relative to the time-series variance and the measurement error variance has a time-series component. He also argues that the endogeneity bias is made worse in panel regressions because if transitory aspects of policy driven by business cycles while the average policy is the relevant to long-term growth, the average will be absorbed by the fixed effects, while the regression will only capture the transitory aspects, which are driven by the business cycle. Finally, Pritchett suggests that panel regressions are more prone to dynamic misspecification—namely, the choice of growth window

imposes the assumption that the adjustment dynamics of all explanatory variables is the same.

I also note that the assumption of uniform technical progress, although common, is not innocuous, particularly when I consider that institutions (my variable of interest) are likely to affect the ability of countries to adopt new technologies (and thus their effective rate of technical progress). Although these concerns have led us to favor the growth episode strategy, it is nonetheless reassuring that the results from the panel data analysis are generally in line with those arising from the episodic approach. Finally, in the context of growth analysis, the first-difference of explanatory variables (such as the improvement in institutions) may still be correlated with country-specific errors.

Key Variables and Data Description

Sustained Growth and Growth Episodes

In order to capture sustained growth, I propose identifying episodes when countries experienced robust growth over a number of years. I define a "growth episode" (GE) as a dichotomous variable that takes the value of 1 if real GDP growth (the percentage change over the past year of GDP measured in constant local currency) is greater than 4% per year for at least 5 consecutive years (a sustained growth episode), and 0 if growth is greater than 4% per year for the first year, but then falls below 4% for at least one out of the following five years (an "unsustained" growth episode). To eliminate unsustained episodes where growth is strong but just fails to reach the threshold in a given year, I eliminate from the sample unsustained episodes where the

average growth over five years is over 4%. Thus, GE=1 represents the case where growth is sufficiently high and sustained such that business cycle or other shocks are not sufficient to reduce growth below 4% in a given year. This is in contrast with unsustained episodes, where initial growth is either vulnerable to later shocks or where the initial growth came from a positive shock that dissipates.

In the analysis of the impact of sustained growth on debt sustainability, I consider broad growth as opposed to per-capita growth because the former is more closely related to a country's ability to service its debt. In the second part of the chapter, where I am concerned with growth itself, I also perform the analysis for real per-capita growth, and the patterns of sustained growth that emerge were broadly similar to the case where overall growth was used.

Although the choice of threshold for growth in the analysis has a degree of arbitrariness, the growth episode variable turns out to have two important characteristics: i) at the outset, both types of growth episodes are similar; and ii) growth episodes are related to long-term growth. Moreover, the results in the analysis are generally robust to changes in thresholds or the minimum episode length, as discussed in greater detail in Section VI.

The importance that both types of episodes be similar at the outset has been alluded to earlier: it allows episodes to function as an "instrument" for growth, uncorrelated with the previous growth component of institutional measures. Suppose that a country has been growing over the past five years. It is plausible that upon seeing such growth, the economist who assigns the institutional ratings may conclude that institutions and policies must have improved and thus assigns a higher

institutional score.[4] If growth is persistent, changes in the institutional variable may well be predictive of growth, but only to the extent that previous growth predicts future growth, which is clearly not interesting. On the other hand, since both types of episodes are similar in their first year (growth over 4%), but also in the five years prior (see Table 4.1 below), institutional ratings would only be able to predict the onset of growth episodes if they contain information that is unrelated to previous growth. This strategy therefore attempts to address the endogeneity problem inherent in any analysis of growth and institutions.

Table 4.1 illustrates the discussion above: GDP performance in the previous five years and in the year of onset is similar for both unsustained and sustained episodes (3.2% and 7%, respectively), as required for my estimation strategy.[5] The performance in the subsequent five years, on the other hand, is very different by construction, with countries having the sustained growth episodes growing an average of 6.7%, while the average of unsustained growth cases grow only 1.7%. The difference in average growth rates between 1980 and 2000 is also very pronounced (2.8% vs. 0.7%, respectively). In total, I identified 475 unsustained growth episodes and 69 sustained growth episodes.

Table 4.1: Characteristics of the GE Variable

	GE	N	mean	min	max	GE	N	mean	min	max
averdgdp	0	466	1.15%	(0.110)	0.115	1	69	5.07%	0.020	0.100
dY		475	7.06%	(0.160)	0.235		69	7.26%	0.041	0.210
dYL5		440	3.16%	(0.099)	0.135		66	3.17%	(0.058)	0.107
dYF5		475	1.74%	(0.093)	0.040		69	6.65%	0.039	0.176
dyd0080		402	0.71%	(0.050)	0.061		53	2.76%	(0.014)	0.080

averdgdp is the average GDP growth during the episode; dY is the percentage growth of GDP, measured in constant local currency, in the past year; dYL5 is GDP growth in the last 5 years; dYF5 is GDP growth in the following 5 years; and dyd0080 is per-capita GDP growth between 1980 and 2000.

Finally, Table 4.2 shows the correlation between different growth measures and confirms that the GE variable is not correlated with previous growth (both in the last year or last five years), only future growth (not only in the next five years, but also in the long term).

Table 4.2: Correlation of Growth Episodes with prior and future GDP Growth

	ldYL5	dY	dYF5	dyd0080
GE	**-3.4%**	**0.8%**	**61.6%**	**34.2%**
	500	544	544	455
dYF5	27.1%	26.8%		
	4686	5219		

Table 4.2 also suggests that growth episodes are likely to be related to long-term growth (as seen in the 34% correlation between growth episodes and average per-capita growth between 1980 and 2000), the variable I am ultimately interested in. A cross-country OLS regression of 20-year growth rates on a variable that adds the years that a country experienced sustained growth confirms that growth episodes are significantly correlated to long-term growth.

In summary, I created a simple filter that identifies episodes of sustained growth. These episodes are uncorrelated with previous growth, which helps address endogeneity concerns, but they are highly correlated with long-term growth.

Having defined a growth episode, I define a related variable, "GEYEAR," that takes the value of 1 if the country is experiencing a sustained growth episode during that year, and 0 otherwise (provided GDP growth data were available). This variable has a higher frequency than GE and is more suitable for the analysis of the

relationship between sustained growth and debt distress since it is plausible that a country in any year (as opposed to the first year) of a growth episode should be less likely to experience debt distress.

Debt and Debt Distress

My measures of debt and debt distress are taken from KN. The measure for the stock of debt is an estimate of the Net Present Value (NPV) of debt from Dikhanov (2003), who takes into account the fact that some countries have concessional loans that effectively contain a grant element in them, while others must pay market-based interest rates. Dikhanov applies a constant and uniform discount rate across time and countries, which may not be generally adequate but addresses the goal of correcting for the effect of concessionality on debt burdens. As measures of debt burden I use ratios of NPV of debt to GDP (NPVGDP), NPV of debt to exports (TDSEXP), and NPV of debt to exports (NPVEXP). The denominators are taken from the IMF's International Financial Statistics database.

Debt distress is defined as in KN. A country is considered to be in debt distress when either of the following is true: i) the country receives Paris Club[6] relief (data compiled by KN from information provided by the Paris Club); ii) the country has over 5% of its debt outstanding in arrears (data from the World Bank's Global Development Finance (GDF) database); or iii) the country has an IMF program with a commitment over 50% of the country's quota. Countries must meet any one of these conditions for at least three consecutive years to be classified as experiencing debt

distress. Moreover, KN define "normal times" as non-overlapping periods of five years during which none of the three conditions above are met.

Policies and Institutions

The main measure of policies and institutions used in this chapter is the World Bank's Country Policy and Institutional Assessment (CPIA), an index developed by the World Bank to measure how conducive a country's current policy and institutional framework is to economic growth, poverty reduction and use of development assistance. The stated focus of this measure is the key elements that are within the country's control, rather than on outcomes (such as growth rates) that are outside the government's control. The CPIA tool was developed and first employed in the mid-1970s, such that the CPIA is available annually since 1977 for most countries of interest, which is a key benefit over other institutional variables since it allows us to study changes over time. On the other hand, until recently the CPIA has not been publicly available and thus it could be difficult to replicate my results.

The CPIA consists of 16 criteria grouped in four equally weighted clusters: Economic Management, Structural Policies, Policies for Social Inclusion and Equity, and Public Sector Management and Institutions (see Box 4.1 below). Countries are rated on a scale of 1 (low) to 6 (high) in each criterion. The scores depend on the level of performance in a given year assessed against the criteria, rather than on changes in performance compared to the previous year. The scores are ultimately subjective, but they do take into account a variety of indicators and other data (produced by the World Bank and elsewhere), and judgments are based on generally in-depth country

knowledge. These scores are averaged—first to yield the cluster score, and then to determine a composite country rating as the average of the four clusters. A principal components analysis of the CPIA revealed that the equal weights were statistically justified.

Box 4.1 CPIA Criteria

A. Economic Management

1. Macroeconomic Management
2. Fiscal Policy
3. Debt Policy

B. Structural Policies

4. Trade
5. Financial Sector

6 Business Regulatory Environment

C. Policies for Social Inclusion and Equity

7. Gender Equality
8. Equity of Public Resource Use
9. Building Human Resources
10. Social Protection and Labor
11. Policies and Institutions for Environmental Sustainability

D. Public Sector Management and Institutions

12. Property Rights and Rule-based Governance
13. Quality of Budgetary and Financial Management
14. Efficiency of Revenue Mobilization
15. Quality of Public Administration
16. Transparency, Accountability, and Corruption in the Public Sector

Source: World Bank

The CPIA is a key factor used to determine the allocation of funds from the International Development Association (IDA) to client countries. Countries with higher CPIA scores generally receive proportionally larger allocations from IDA. Therefore, World Bank staff working on a given country may have a potential upward bias towards ratings. However, a review process is in place to challenge CPIA ratings, thus placing a check on such potential bias. Country economists must thoroughly justify (and often defend) each score given. Moreover, there is another, potentially helpful, bias in that countries with severe governance or institutional problems are likely to be disengaged with the international financial community, including the World Bank, which generally provides incentives for a downward bias.

The World Bank has periodically reexamined the criteria and revised them to reflect the experience and evolution of applied development economics. Over time, the assessment criteria have shifted from a largely macroeconomic focus to include governance aspects and a broader coverage of social and structural dimensions. Some of these changes refined some of the criteria, or added new ones; others modified the process. In 1997, for example, criteria covering governance-related issues were added. These changes have the disadvantage of limiting comparability over time, but given the findings from principal components analysis regarding the explanatory power of individual components, it is likely that the measure overall remained relatively stable as a subjective judgment of World Bank staff regarding the suitability of a country's institutions to growth and development.

To address concerns related to the largely non-public nature of the data, I compared the CPIA with publicly available data from Kaufmann, Kraay and

Mastruzzi (2005; henceforth KKM) to demonstrate that the CPIA is reasonably correlated with well-known institutional variables. KKM data are available biannually from 1996 to 2004 on voice and accountability (VA), political stability (PS), government efficiency (GEFF), control of corruption (CORR), regulatory quality (REG) and rule of law (RLAW). The correlations between these variables and the CPIA are listed in Table 4.3 below and vary between 53% (VA) and 85% (GEFF).

Table 4.3: Correlation of the CPIA with other Institutional Variables

	GEFF	VA	PS	REG	RLAW	CORR
CPIA	85.0%	52.8%	59.6%	79.3%	73.8%	70.3%

Controls

In my analysis of the relationship between sustained growth and debt distress, I use different measures of shocks and institutions from those used in KN. First, consider KN's measure of shocks, GDP growth in the year prior to a distress episode. I can write this measure as $DGDP(t-1,t-2) = DGDP(\text{trend}) + SHOCK(t-1)$. I am interested in separating the shock from the trend, and therefore I will use $SHOCK(t-1) = DGDP(t-1,t-2) - DGDP(trend)$. DGDP(trend) may be either DGDP in the previous five years, or the GDP growth over the entire period for which data are available.[7] Moreover, since the CPIA is highly correlated with previous growth, I use an average of KKM's GEFF variable between 1996 and 2000 as a proxy for institutions in the probit analysis of debt distress episodes.

In the analysis of the relationship between institutions and growth, I follow Sala-i-Martin (1997) and include as additional controls two of the most robust predictors of economic growth: the price of investment and school enrolments. I take data on the price of investment (PINVEST) from the Penn World Tables. Data on education are from the World Development Indicators dataset. I use two education variables: PRIENR, which is enrolment rate in primary education, and SECENR, an analogous variable for secondary level enrolment rates. Data on education is only available in intervals of a few years (usually five), and therefore to use the data with my growth episodes I filled in missing years with the value for the most recent year where data were available. Other controls are discussed as they are introduced.

In the panel data analysis I use standard controls for growth regressions, namely the average rates of investment and population growth (the latter adjusted by 5% to take into account depreciation and technological change, as has been standard since Mankiw, Romer and Weil 1992). The data on investment rates are obtained from the Penn World Tables, and population data come from the World Bank's Global Development Finance (GDF) database.

Results

Does sustained growth predict debt distress?

Recall that the GEYEAR variable represents whether a country is experiencing a sustained growth episode during that year (GEYEAR=1). A first look at the correlation between the GEYEAR variable and KN's dependent variable ("debt distress"= 1, "normal times"= 0) in Table 4.4 below is suggestive of the results I find

in the econometric analysis: the probability of debt distress conditional on being in a growth episode in the previous year is 12%, increasing to 37% otherwise. Very few countries go into debt distress following a year of a growth episode; it is worth noting that three of the six countries that experienced debt distress following a growth episode were Thailand, Korea and Indonesia during the Asian financial crisis.

Table 4.4: KN Dependent Variable and Growth Year

	KN DEPVAR		
GEYEAR	0	1	Total
0	109	64	173
1	46	6	52
Total	155	70	225

I include the GEYEAR variable in my modified version of KN's main regressions. The results are summarized in Table 4.5 below, where the dependent variable is the same as in KN. GEYEAR is always significant at least at the 90% level and generally significant at the 95% level. There are only a relatively small number of years during a growth episode for which data on the other variables are available (42 for the regressions with NPVEXP and 47 for the regressions with TDSEXP), and thus the power of the regressions would be expected to be low. However, even with low statistical power, the effect of sustained growth on debt distress is evident. Even using the lowest estimate on the coefficient of GEYEAR (equation IV), being in a growth episode cuts in half the probability of debt distress (from 32% to 16%).

Table 4.5: Dependent Variable: Debt Distress, Probit Results

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
GEYEAR	**-0.80**	**-0.75**	**-0.70**	-0.54	**-0.61**	**-0.74**	**-0.67**	**-0.88**	**-0.73**	-0.60	-0.55	**-0.69**
	3.12	*2.80*	*2.56*	*1.90*	*2.18*	*2.85*	*2.49*	*3.03*	*2.46*	*1.92*	*1.72*	*2.26*
TDSEXP		**3.13**	**3.07**	**3.13**	**3.26**							
		4.72	*4.61*	*4.60*	*4.80*							
NPVEXP									**0.49**	**0.56**	**0.53**	**0.46**
									4.35	*4.60*	*4.31*	*4.10*
SHOCK			**-4.95**	**-5.22**		**-5.19**				**-10.86**	**-10.91**	
			2.01	*2.09*		*2.30*				*3.69*	*3.72*	
GEFF				**-0.44**	**-0.42**		**-0.36**				-0.22	-0.18
				2.43	*2.37*		*2.14*				*1.09*	*0.97*
LR Chi2	10.78	37.95	42.08	48.25	43.79	16.19	15.50	10.56	35.34	50.51	51.73	36.30
R^2	0.046	0.161	0.178	0.204	0.185	0.069	0.066	0.051	0.169	0.242	0.248	0.174
Obs	191	191	191	191	191	191	191	177	177	177	177	177

It should be noted that the statistics for the GEYEAR variable are somewhat weaker when I am restricted to use samples for which CPIA data are available. Repeating the regressions in Table 4.5 using data for which CPIA data are available makes GEYEAR significant at least at the 90% level in all regressions except the counterparts of X and XI. On the other hand, both the magnitude and t-statistic of the GEYEAR coefficient in equation I are larger when I am allowed to use all available data (all 225 episodes listed in Table 4.4).

Replacing GEYEAR with DGDPL5, GDP growth in the previous five years, in the regressions in Table 4.5 gives an even clearer picture of the importance of previous growth to debt sustainability. Table 4.6 below shows the results of this analysis. Growth in the five years prior to a debt distress episode is strongly significant under all specifications and confirms the results of Table 4.5. Growth in the five years prior to a debt distress episode was 1.6% on average, compared to GDP growth rate of 4.4% in the five years prior to a "normal" episode.

Table 4.6: Dependent Variable: Debt Distress, Probit Results

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
DGDPL5	**-7.13**	**-7.12**	**-7.03**	**-6.43**	**-6.28**	**-7.07**	**-6.52**	**-8.17**	**-7.87**	**-8.59**	**-7.58**	**-8.36**
	3.41	*3.20*	*3.16*	*2.78*	*2.71*	*3.37*	*3.04*	*3.30*	*2.92*	*3.08*	*2.76*	*2.94*
TDSEXP		**3.10**	**3.11**	**3.43**	**3.38**							
		5.74	*5.68*	*5.99*	*5.88*							
NPVEXP									**0.51**	**0.60**	**0.49**	**0.57**
									4.43	*4.67*	*4.12*	*4.35*
SHOCK			**-5.07**		**-5.09**	**-4.80**				**-12.67**		**-12.57**
			2.56		*2.53*	*2.66*				*4.09*		*4.09*
GEFF				**-0.46**	**-0.46**		**-0.30**				-0.20	-0.22
				3.12	*3.10*		*2.27*				*1.06*	*1.05*
LR Chi2	12.21	50.76	57.35	61.05	67.49	19.34	17.49	11.46	37.54	56.52	38.68	56.47
R^2	0.037	0.155	0.175	0.186	0.206	0.059	0.053	0.055	0.180	0.027	0.185	0.270
Obs	303	303	303	303	303	303	303	177	177	177	177	177

It is not instructive to include growth measures and the CPIA in the right-hand side of the probit regressions above because CPIA levels are strongly related to previous growth. Table 4.7 below shows that the correlation between the CPIA levels and previous growth ranges between 24% and 27%. Cross-country regressions confirm that CPIA levels are, to a large extent, caused by previous growth, not only because of the lag with which economists observe growth-enhancing changes in institutions and policies, but also because growth allows countries to improve their institutions (for example, the scores on education and macroeconomic policies are likely to be helped by growth).

This observation does not mean that the CPIA does not contain information about institutions that is relevant to debt sustainability, but rather that the CPIA is likely to be capturing the effects of growth in addition to that of institutions. The mostly significant coefficients on the proxy for institutions I used (an average of KKM's government effectiveness measure) support this conjecture. I also investigated

this claim further by using another proxy for institutions that is, in principle and in fact, uncorrelated with previous growth—namely the index of political fractionalization from the Database of Political Institutions (Beck et al. 2001). Greater fractionalization, particularly in the context of developing countries, suggests greater accountability and stronger government institutions. Table 4.7 shows that political fractionalization is correlated with the CPIA and the GEFF variable, but not with previous growth. Although GEFF(a) also has low correlations with previous growth, this variable is computed only from 1996-2000, and it is not strictly exogenous as one could argue FRAC is[8].

Table 4.7: Correlations between Institutional Variables and Growth

	dY	dYL5	dYL10	GEFF(a)	CPIA
FRAC	3.0%	-4.1%	-12.3%	38.8%	23.0%
CPIA	22.9%	24.0%	26.7%	61.6%	
GEFF(a)	9.5%	9.4%	11.4%		

The results of the new regressions are shown below in Table 4.8. Although the number of data points is relatively small (and too small to reproduce all the results of Table 4.5), the strongly significant coefficients on growth episode years and previous growth, as well as on the proxy for institutions (now significant when using either measure of debt burden, unlike the results with GEFFa) support my conjecture that institutions do matter directly for debt sustainability, but previous growth is equally critical and is likely to also be picked up by the CPIA. I also ran the regressions in Table 4.8 using growth in the previous 10 years, but the results were similar and the

number of observations falls further and reduces the overall significance of the regression.

Table 4.8: Dependent Variable: KN Debt Distress Episode, Probit Results

	I	II	III	IV
GEYEAR	**-1.14**	**-1.26**		
	3.01	*2.62*		
DGDPL5			**-8.68**	**-9.53**
			3.36	*3.00*
TDSEXP	**2.92**		**3.19**	
	3.55		*4.31*	
NPVEXP		**0.60**		**0.67**
		3.68		*3.92*
SHOCK	**-5.97**	**-11.47**	**-5.52**	**-14.17**
	2.03	*3.31*	*2.17*	*3.82*
FRAC	**-0.98**	-0.75	**-1.24**	**-1.06**
	2.61	*1.82*	*3.56*	*2.47*
LR Chi2	44.05	49.04	46.33	51.50
R^2	0.233	0.300	0.209	0.310
Obs	149	137	180	138

What is the effect of debt on growth?

It is important at this point to ask whether the relationship between growth and debt distress that I observe above is ultimately the result of the negative effect of high debt burdens on economic growth. In that case, if debt burdens are persistent, they could be causing both debt distress and lower growth, thus overestimating the independent impact of growth on debt sustainability.

To assess this hypothesis and anticipating the next section, I performed (i) system-GMM regressions similar to the ones in Bond et al. (2001) but including the log of debt burden ratios as explanatory variables, and (ii) probit analysis that asks whether debt levels can predict the onset of growth episodes (that is, are countries

with lower debt burdens more likely to enter a growth episode?). As shown in Table 4.9 below, I find no evidence of links between debt burdens and economic growth. Significance levels are extremely low across all measures of debt burdens and all econometric specifications, and some coefficients even turn out to be positive.

These results are in line with other findings in the literature, such as Imbs and Ranciere (2005), who find that the partial correlation between initial debt and subsequent growth is mostly insignificant, and Patillo et al. (2002), who argue for quadratic effects of debt on growth but generally do find any linear effects. I do not favor a quadratic specification when linear effects are absent, and even the quadratic effects argued by Patillo et al. are generally insignificant at a 90% confidence level under the preferred system GMM specification.

Table 4.9: Effect of Debt on Growth

	I	II	III	IV	V	VI
DEPVAR	dyF5	dyF5	dyF5	GE	GE	GE
NPVGDP	0.02			0.03		
	0.78			*0.14*		
NPVEXP		0.05			-0.05	
		1.10			*0.73*	
TDSEXP			-0.01			-0.55
			0.36			*0.83*
LNy	-0.06	-0.05	**-0.09**			
	1.48	*1.40*	*2.43*			
INVRATE	**0.30**	**0.31**	**0.29**			
	4.32	*4.27*	*5.00*			
POP	-0.06	-0.12	-0.12			
	1.48	*0.65*	*0.68*			
y1977				-1.6E-04	-1.8E-04	-1.2E-04
				1.73	*1.86*	*1.66*
LR Chi2	40.29	49.43	59.30	3.78	4.51	4.02
R^2						
Obs	280	279	353	251	249	308
	sys-GMM	sys-GMM	sys-GMM	Probit	Probit	Probit

System GMM regressions include time dummies. See notes to Table 4.16 below.

What does seem to find some support in the data is the reverse hypothesis that debt ratios are influenced by growth. Table 4.10 shows system-GMM regressions of debt burden ratios on GDP growth. The coefficient on growth is significant in the regression where the ratio of NPV of debt to exports is used as my measure of debt burden, and although the relationship is weaker in the regressions that use as measures of the debt burden the ratio of debt service to exports and the ratio of NPV of debt to GDP, the sign is consistently negative. This evidence suggests that the effect of growth on debt distress might actually be *under*stated in the analysis above, particularly when one observes that neither the growth rate of debt service nor of the debt stock seem to predict distress episodes in the KN regressions, only the ratios.

Table 4.10: Effect of Growth on Debt Ratios—System GMM estimates

	I	II	III
DEPVAR	NPVGDP	NPVEXP	TDSEXP
NPVGDP (t-1)	**0.44**		
	2.42		
NPVEXP (t-1)		**0.66**	
		9.84	
TDSEXP (t-1)			**0.19**
			2.85
dLNy	-2.90	**-3.38**	-1.23
	1.46	*5.78*	*0.97*
LR Chi2	38.97	173.73	60.61
Sargan	0.475	0.415	0.350
Obs	332	311	386

Regressions include time dummies. See notes to Table 4.16 below.

I go into greater detail on the growth-debt nexus in a companion paper (Gil Sander, Hjort and Thomas 2008), but the evidence there as well as that presented here strongly suggests that the relationship between growth and debt distress is robust and not the result of a negative effect of debt burdens on growth. Instead, it is more likely

that including both growth and debt ratios as explanatory variables for debt distress may actually underestimate the role of growth.

Do changes in policies and institutions predict sustained growth?

Probit analysis of growth episodes

After establishing the relationship between economic growth and debt distress, I proceed to analyze the role of institutions in promoting sustained economic growth. I start by asking whether changes in institutions, more specifically changes in the CPIA ("DPIA") can predict the onset of sustained growth episodes. As discussed earlier, growth episodes are designed to prevent any correlation between changes in the CPIA and present or past growth to appear to predict future growth. The DPIA variable is not correlated with growth in the previous five years, but it is correlated with contemporaneous growth. However, in both types of episode the average growth rate during that first year turns out to be similar[8] (see Table 4.1: the growth rate in the first year of both types of episode is around 7%, both in the entire sample but also in the sub-sample of country-years for which the DPIA data are available). Thus, changes in the CPIA would not be expected to predict growth episodes unless those changes contain information that is forward-looking.

Although my analysis departs from conventional growth empirics, I must still take into account the effects of convergence. Table 4.11 below shows that countries that were already wealthy in 1977 grow more in the 1980-2000 period (absolute divergence), but not through growth episodes. Growth episodes are negatively

correlated with initial income, which is in line with growth theory: wealthier countries are closer to their steady state and grow at more modest rates, thus making it more likely that business cycle shocks would bring growth rates below the 4% threshold on a given five-year period. The positive correlation between 1977 income and the 20-year growth rate is the result of wealthy countries experiencing less volatility in growth rates. The correlation between 1977 per capita income and the standard deviation of the growth rate between 1980 and 2000 (one measure of growth volatility) is negative 28%. Meanwhile, including volatility in the cross-country regression of 20-year growth shows that volatility is strongly negatively correlated with growth. Thus, I include a measure of initial income (the income in 1977, the initial year for my CPIA data series) in my regressions to take into account those convergence effects

Table 4.11: Correlations of Initial Income, Growth Episodes, and 20-year Growth Rates

	GE	y77
dyd0080	34.2%	17.5%
y77	-10.1%	

Regression I in Table 4.12 shows that the change in the CPIA is a significant predictor of growth episodes. I have also included the level of the CPIA the year prior to commencement of the growth episode and my control for convergence. Initial income has the expected negative sign, but the level of the CPIA does not appear to be predictive of growth episodes, likely because of its high correlation with income levels

(24%). However, the change in CPIA from the year prior to the start of the growth episode does have predictive power whether the level of the CPIA or 1977 income are included. Recall that although those changes are somewhat correlated with recent growth (9%), the structure of growth episodes does not allow them to be predicted using past growth. The main regression is V below, which implies that a country with income of US$500 in 1997 can increase its probability of entering a growth episode by 14 percentage points with an improvement of 1 point in its CPIA score.

Table 4.12: Dependent Variable: GE, Probit Results

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
DPIA	**0.56**	**0.45**			**0.47**		**0.45**	**0.46**	0.22	**0.59**	0.28	**0.58**
	2.89	*2.03*			*2.12*		*2.02*	*2.03*	*0.61*	*2.08*	*0.77*	*2.06*
PIA			0.03			0.13	0.01	0.11				
			0.28			*1.12*	*0.07*	*0.92*				
y1977				**-2.0E-04**	**-2.1E-04**	**-2.3E-04**		**-2.3E-04**			-2.6E-04	3.3E-04
				2.29	*2.35*	*2.42*		*2.42*			*1.74*	*0.53*
LR Chi2	8.56	4.16	0.08	7.19	11.73	8.45	4.17	12.59	0.37	4.42	5.06	4.69
R^2	0.003	0.018	0.000	0.031	0.050	0.036	0.018	0.054	0.004	0.032	0.054	0.034
Obs	360	303	303	303	303	303	303	303	150	153	150	153

In Equations IX—XII I split the sample between countries with income per capita in 1977 above (IX, XI) and below (X, XII) US$1,000. Similarly to the way in which the CPIA appears more important than debt indicators in predicting debt distress among poor countries (noted by KN), changes in the CPIA seem to be especially valuable for poorer countries. Equation X suggests that a country with 1977 income of US$500 could increase their probability of entering a growth episode by 18 percentage points with a one-point improvement in its CPIA score.

In Tables 4.13 and 4.14 I subject DPIA to the various controls discussed in Section IV-2, namely primary and secondary enrollment ratios, the price of

investment, as well as a dummy variable for sub-Saharan Africa, which often appears to be significant in growth regressions. Table 4.8 excludes 1977 income, which allows for a larger sample size and more precise estimates of the DPIA coefficient. When 1977 income is included (Table 4.14), the sample size decreases, increasing standard errors. Nonetheless, the DPIA tends to stay significant at least at the 90% level. As further check, I included contemporaneous GDP growth, as well as GDP growth in the previous five years as controls, but those variables were never significant and did not change the significance of the DPIA variable.

Among the control variables tested, educational variables, particularly primary school enrollment, tend to be robust predictors of sustained growth when initial income is taken into account. This finding is consistent with a number of cross-country growth regressions. Although the price of investment appears with the correct sign, its statistical significance is low. Perhaps surprisingly, the dummy for sub-Saharan Africa is largely insignificant. I also tested other economic variables not in Tables 4.13 and 4.14, but only two (related) variables had some potential predictive power: real exchange rate depreciations and current account surpluses (coefficients were not always significant, however). Changes in terms of trade, inflation, and budget deficits do not help predict growth episodes.

Table 4.13: Dependent Variable: GE, Probit Results

	I	II	III	IV	V	VI	VII	VIII	IX
DPIA					**0.47**	**0.51**	**0.49**	**0.50**	**0.49**
					2.30	*2.47*	*2.43*	*2.42*	*2.33*
PRIENR	5.2E-03				4.7E-03				3.2E-03
	1.46				*1.31*				*0.69*
SECENR		4.5E-03				5.1E-03			5.1E-03
		1.29				*1.44*			*0.95*
PINVEST			-3.0E-03				-3.3E-03		-3.4E-03
			1.21				*1.28*		*1.29*
SSA				-0.06			-0.09	-0.09	0.23
				0.34			*0.50*	*0.50*	*0.93*
LR Chi2	2.20	1.65	1.63	0.11	7.87	7.87	7.63	6.07	10.35
R^2	0.009	0.007	0.006	0.000	0.031	0.031	0.030	0.024	0.041
Obs	310	310	310	310	310	310	310	310	310

Table 4.14: Dependent Variable: GE, Probit Results

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
DPIA					0.40	**0.46**	0.41	**0.49**	0.42	**0.46**	0.40
					1.69	*1.96*	*1.83*	*2.16*	*1.75*	*1.96*	*1.67*
y1977	**-4.2E-05**	**-5.9E-05**	-2.9E-05	**-4.1E-05**	**-3.5E-04**	**-5.0E-04**	**-2.0E-04**	**-3.2E-04**	**-4.2E-04**	**-5.2E-04**	**-5.0E-04**
	2.55	*2.81*	*1.76*	*2.58*	*2.96*	*3.47*	*2.23*	*2.80*	*3.11*	*3.52*	*3.39*
PRIENR	**7.2E-03**				**1.4E-02**				**1.2E-02**		
	2.05				*3.06*				*2.52*		
SECENR		6.8E-03				**2.1E-02**				**1.9E-02**	**2.0E-02**
		1.95				*3.77*				*3.06*	*3.12*
PINVEST			-2.8E-03				-3.5E-03				-2.4E-03
			1.16				*1.26*				*0.86*
SSA				-0.36				**-0.55**	-0.37	-0.22	-0.07
				1.91				*2.46*	*1.56*	*0.88*	*0.26*
LR Chi2	10.45	9.87	6.03	9.31	20.73	25.32	11.56	18.04	23.10	26.11	24.13
R^2	0.035	0.033	0.021	0.029	0.092	0.112	0.053	0.078	0.103	0.116	0.113
Obs	413	413	384	440	291	291	284	303	291	291	273

Finally, in Table 4.15 I consider some political variables that have been reported to be related to growth. I use data from the Database of Political Institutions (Beck et al., 2001) to test whether the following variables might help predict the onset of a growth episode: a) the system of government or, more accurately, the type of democracy, SYSTEM, (direct presidential, indirect presidential or parliamentary); b) the tenure of current system or executive, TENSYS; c) electoral competition, as

measured by the Executive Index of Electoral Competition ("EIEC"); d) whether the government is military, MILITARY; or e) whether sub-national units have fiscal authority (federalism), FEDER. My results agree with those of Persson (2005) in finding that the type and age of the democracy (but not the age of the system in general) are also related to sustained economic growth. I do not find effects of military government, electoral competition or federalism on growth. It is interesting, though not surprising from equations IX—XII in Table 4.12, to note that DPIA is not significant for the sub-sample of relatively advanced democracies (measured as having a score of 6 or 7 in the EIEC[10]), although the sample sizes are too small for strong conclusions.

Table 4.15: Dependent Variable: GE, Probit Results

	I	II	III	IV	V	VI
DPIA	**0.48**	**0.48**	0.28	**0.49**	**0.47**	0.72
	2.04	*2.08*	*0.90*	*2.15*	*2.08*	*1.91*
y1977	**-2.1E-04**	**-2.0E-04**	**-4.2E-04**	**-2.0E-04**	**-2.0E-04**	**-3.6E-04**
	2.36	*2.30*	*2.72*	*2.20*	*2.30*	*2.03*
SYSTEM	**0.30**					
	2.53					
TENSYS		7.7E-03				
		0.87				
TENSYS*			**2.5E-02**			
			2.20			
COMPET				1.3E-02		
				0.29		
MILITARY					-0.16	
					0.78	
FEDER						0.27
						0.77
LR Chi2	16.22	11.89	15.87	11.22	11.75	10.89
R^2	0.072	0.052	0.133	0.049	0.051	0.130
Obs	291	292	156	292	292	97

TENSYS* is the TENSYS variable restricted to countries with an EIEC score of 6 or 7.

Panel data analysis

To ensure that my results are not driven by the specific estimation strategy based on growth episodes, I proceed to test whether changes in the CPIA appear to be significant predictors of economic growth under more standard panel data techniques. Namely, I included the DPIA (in log difference) in standard panel growth regressions using OLS, fixed- and random-effects, and system-GMM, which as I discussed earlier is the preferred estimator due to its greater robustness. The results are displayed in Table 4.16 below. Changes in the CPIA are significant at least at the 90% level under all but one specification, and I note that my results would be strengthened by the inclusion of growth over the same year as the change in CPIA (which I included as a control due to the correlation between contemporaneous growth and the changes in CPIA discussed above).

The generally greater magnitude and significance of the DPIA variable under more traditional techniques might suggest endogeneity, which would render the OLS, fixed- and random-effects estimators inconsistent, but I do not find a correlation between DPIA and growth in the previous five years.

Table 4.16: Dependent Variable: DyF5, Panel Regression Analysis

	I	II	III	IV	V	VI	VII	VIII
DPIA	**0.20**	**0.22**	**0.26**	0.10	**0.16**	0.15	**0.17**	**0.26**
	2.66	*2.78*	*4.01*	*1.08*	*1.97*	*1.73*	*2.00*	*2.70*
LNy	-0.02	**-0.41**	0.04	**-0.09**	**-0.11**	**-0.08**	-0.06	**-0.08**
	1.84	*8.58*	*1.27*	*3.05*	*3.29*	*2.17*	*1.49*	*2.74*
INVRATE	**0.12**	**0.15**	**0.12**	**0.26**	**0.26**	**0.25**	**0.26**	**0.25**
	7.39	*4.30*	*7.31*	*5.43*	*5.43*	*5.48*	*5.82*	*5.27*
POP	-0.14	0.02	-0.09	-0.29	-0.25	-0.21	-0.27	-0.30
	1.81	*0.12*	*1.44*	*1.56*	*1.36*	*1.18*	*1.48*	*1.72*
PRIENR						3.8E-04		
						0.00		
SECENR							-0.02	
							0.51	
PINVEST								**5.9E-04**
								2.38
Wald/F	14.23		144.48	52.35	54.63	54.72	71.78	76.89
Sargan				0.291	0.529	0.367	0.492	0.193
Obs	325	325	294	325	300	314	314	324
	OLS	FE	RE	sys-GMM	sys-GMM	sys-GMM	sys-GMM	sys-GMM

All regressions include year dummies. All rates are in logs. LNy is the log of per capita GDP measured in constant US dollars. Equation III includes the log of 1977 income (negative and significant at the 90% level). System GMM regressions were performed with the xtabond2 command (Roodman 2005) for STATA and use the two-step estimator with the Windmeijer (2005) standard-error correction. In system GMM, instruments for difference equations are all available lags of right-hand-side variables; instruments for level equations are all contemporaneous and earlier first-differences. The year dummies are used as strictly exogenous instruments for level equations. In equation V I excluded countries with incomes above US$5,000.

In the system GMM estimation, differently from Bond et al. (2001), who use a one-step estimator, I use the two-step variant because it is asymptotically more efficient, and unbiased estimates of standard errors are now available through the Windmeijer (2005) correction[11]. Aside from the coefficient in the DPIA, my findings generally match those in Bond et al. (2001). Similar to those authors, I do not find any effect of enrollment rates, most likely because, as argued by Pritchett, the effect of persistent variables tends to disappear in panel analysis, in this case because of first-differencing. The change in signal in the price of investment is likely related to a strong correlation with the investment rate. When the regression with the price of investment

excludes the investment rate, the coefficient on the price of investment becomes negative but is statistically insignificant.

The system GMM results are similar to the analysis of growth episodes in an interesting respect: the effect of changes in the CPIA is important primarily for poorer countries. In equation V above I exclude countries with income higher than US$5,000, which makes the coefficient statistically significant and also increases its magnitude substantially. When that threshold is lowered to US$1,500, the pattern is repeated: the magnitude of the coefficient jumps to .24 and is significant at the 95% confidence level.

Although it is reassuring that the coefficient on the DPIA variable has the correct sign and is significant under most specifications, I cannot overlook the concerns with panel data estimation, even under system-GMM, which include the strong assumption of constant technological progress and the difficulty with persistent variables. Moreover, Pritchett (2000) warns that the high volatility that most developing countries experience could lead to misleading results driven by fast growth under one five year period, only to be followed by stagnation in the next two periods. Sustained growth, on the other hand, combines robust growth with lower volatility, which seems to be the key to long-term growth for developing countries.

Robustness Checks

I briefly discuss three robustness checks that were analyzed in order to demonstrate that the results are not dependent on the specific filter used to create sustained growth episodes: i) using per-capita income in the growth-institutions analysis; ii) changing

the minimum length of the growth episodes to four or six years; and iii) changing the growth threshold of the growth episode. I discuss each of these robustness checks in turn.

Per Capita Growth Episodes

When analyzing the relationship between institutions and growth, it is clearly more instructive to look at episodes of sustained growth in per-capita terms, and indeed I already shifted to per-capita growth in the panel data analysis of Table 4.16. In Table 4.17 below I replicate some of the regressions from Tables 4.12 – 4.15 using growth episodes that are based on per-capita growth of at least 2.5% per year, for at least five consecutive years, where the average growth over five years of an unsustained episode is not greater than 2.5%. Thus, the only modifications I made to the original filter are to i) replace broad growth with real per-capita GDP growth; and ii) lower the threshold from 4% to 2.5%.

The results from the per capita growth episode analysis are robust and often stronger than those I found for episodes of broad growth. Equation VIII confirms the earlier finding that changes in the CPIA are particularly important for poorer countries (the sample in that equation is restricted to those countries with 1977 income below US$1,000), as shown by the larger magnitude of the coefficient, which is statistically significant notwithstanding a smaller sample size. The equivalent regression restricted to countries with 1977 income above US$1,000 shows an insignificant coefficient on the DPIA. Overall, improvements in the CPIA, particularly

for poorer countries, seem to be very robust predictors of whether a country will enter a growth episode or experience higher growth in the future.

Table 4.17: Dependent Variable: Per-Capita Growth Episodes, Probit Analysis

	I	II	III	IV	V	VI	VII	VIII
DPIA	**0.42**	**0.79**	**0.95**	**1.10**	**0.70**	**0.88**	**1.10**	**1.40**
	2.00	*2.92*	*3.09*	*3.35*	*2.56*	*3.05*	*3.32*	*2.86*
y1977		-1.3E-05	-6.5E-05	**-2.0E-04**	1.7E-05	-8.4E-05	**-2.1E-04**	7.4E-04
		0.22	*0.93*	*2.29*	*0.26*	*1.23*	*2.34*	*1.00*
PRIENR			**0.01**					
			2.45					
SECENR				**0.03**			**0.02**	
				4.18			*3.32*	
PINVEST					-3.8E-03			
					1.23			
SSA						**-0.92**	-0.38	
						3.26	*1.13*	
LR Chi2	4.12	9.34	17.52	30.25	8.86	21.83	31.56	11.06
R^2	0.017	0.048	0.099	0.170	0.048	0.111	0.178	0.121
Obs	299	254	243	243	234	254	243	124

Different Minimum Lengths of Growth Episodes

In Tables 4.18 and 4.19 I changed the definition of growth episodes so that they were either shorter (minimum of four years) or longer (minimum of six years). Since part of the goal of the design of the growth episode filter is to eliminate short-term shocks and business cycle variations, I believe that reducing the length of the episode beyond four years is more likely to reveal business cycle fluctuation and growth shocks rather than sustained growth; on the other hand, increasing the episode length leads to a very small number of episodes. Indeed, in the analysis below I had to lower the growth threshold to 3% for episodes with a minimum of six years, otherwise the number of growth episodes falls to below 10% of the total number of episodes.

Table 4.18 reproduces the main equations of Table 4.5 where "GEYEAR" is derived from the new definitions of growth episodes, whereas Table 4.19 reproduces the main equations of Tables 4.12, 4.13 and 4.14. Once again, the results are actually stronger than the ones I had obtained with the five-year growth episodes (being in a growth episode year is now a significant predictor of no debt distress at the 95% confidence level in all cases).

Table 4.18: Growth Years from Growth Episodes with a minimum duration of 4 and 6 years

	I	II	III	IV	V	VI	VII	VIII	IX	X
GEYEAR	**-0.97**	**-0.79**	**-0.67**	**-0.67**	**-0.63**	**-0.89**	**-0.79**	**-0.69**	**-0.74**	**-0.72**
	4.20	*3.09*	*2.54*	*2.30*	*2.14*	*4.57*	*3.57*	*3.00*	*3.02*	*2.86*
TDSEXP		**3.10**	**3.15**				**3.08**	**3.12**		
		4.60	*4.56*				*4.48*	*4.45*		
NPVEXP				**0.55**	**0.53**				**0.58**	**0.56**
				4.56	*4.27*				*4.71*	*4.44*
SHOCK		-4.79	**-4.93**	**-10.71**	**-10.59**		-4.79	**-4.92**	**-10.32**	**-10.17**
		1.94	*1.97*	*3.65*	*3.61*		*1.94*	*1.96*	*3.52*	*3.47*
GEFF			**-0.43**		-0.22			**-0.41**		-0.18
			2.36		*1.06*			*2.24*		*0.87*
LR Chi2	20.05	45.55	50.96	52.43	53.27	22.39	48.76	53.64	56.48	57.07
R^2	0.072	0.192	0.216	0.250	0.255	0.080	0.206	0.227	0.270	0.273
Obs	225	192	191	178	177	225	192	191	178	177
Length (years)	4	4	4	4	4	6	6	6	6	6

The results in Table 4.19 again seem stronger than my original filter. It is interesting to note that the magnitude of the effect of the change in CPIA seems to increase with the minimum episode length. The (minimum) four- and five-year growth episodes have a coefficient of 0.47, while the (minimum) 6-year episodes have a coefficient of 0.6. Also of note is the persistent difference in effect on poor vs. middle- and upper-income countries: changes in the CPIA are often insignificant in samples of

middle- and upper-income countries, but always significant among poor countries (Equations V and X in Table 4.19).

Table 4.19: Growth Episodes with a minimum duration of 4 and 6 years

	I	II	III	IV	V	VI	VII	VIII	IX	X
DPIA	**0.56**	**0.47**	**0.47**	**0.40**	**0.54**	**0.47**	**0.60**	**0.64**	**0.56**	**0.63**
	3.82	*2.49*	*2.43*	*2.04*	*2.11*	*2.28*	*2.40*	*2.49*	*2.23*	*2.02*
y1977		-5.8E-06	-1.1E-04	1.8E-06	6.3E-04		-9.3E-05	**-2.5E-04**	-1.1E-04	3.2E-04
		0.12	*1.87*	*0.04*	*1.11*		*1.45*	*2.55*	*1.55*	*0.50*
SECENR			**1.3E-02**					**1.5E-02**		
			3.06					*2.77*		
PINVEST				-1.1E-03					-4.1E-03	
				0.52					*1.46*	
LR Chi2	11.59	6.32	14.80	4.56	6.15	5.36	9.57	17.76	11.16	4.63
R^2	0.024	0.019	0.045	0.014	0.036	0.018	0.039	0.075	0.050	0.035
Obs	382	319	305	295	159	293	250	244	232	127
Length (years)	4	4	4	4	4	6	6	6	6	6

Different minimum growth rate thresholds

Finally, I wanted to vary the threshold of a growth episode to 3% and 5%. At 5%, there are again too few sustained growth episodes for my analysis (40 out of 469 episodes), which is why I only show the analysis for the 3% threshold. Growth episode years remain strongly predictive of debt distress, although the changes in CPIA are now significant only at the 90% level in the regressions predicting growth episodes. Tables 4.20 and 4.21 summarize my findings for the 3% threshold. This is the only case where changes in the CPIA are not significant in the sub-sample of poor countries (Table 4.21, Equation V).

Table 4.20: Growth Episodes with minimum growth of 3% for each of 5 years

	I	II	III	IV	V
GEYEAR	**-0.92**	**-0.85**	**-0.71**	**-0.79**	**-0.77**
	4.40	*3.60*	*2.87*	*3.04*	*2.84*
TDSEXP		**3.10**	**3.13**		
		4.51	*4.49*		
NPVEXP				**0.58**	**0.57**
				4.65	*4.45*
SHOCK		-4.48	-4.66	**-10.11**	**-9.97**
		1.82	*1.86*	*3.46*	*3.41*
GEFF			**-0.37**		-0.13
			1.97		*0.61*
LR Chi2	21.24	49.32	52.97	56.86	57.05
R^2	0.076	0.208	0.224	0.271	0.273
Obs	225	192	191	178	177
Threshold	3%	3%	3%	3%	3%

Table 4.21: Growth Episodes with minimum growth of 3% for each of 5 years

	I	II	III	IV	V
DPIA	0.35	0.39	0.43	0.35	0.32
	1.87	*1.81*	*1.90*	*1.61*	*1.17*
y1977		-7.7E-05	**-2.1E-04**	-9.0E-05	-4.4E-05
		1.41	*2.71*	*1.50*	*0.07*
SECENR			**1.5E-02**		
			3.05		
PINVEST				-2.3E-03	
				1.03	
LR Chi2	3.58	5.75	15.59	6.26	1.38
R^2	0.010	0.019	0.055	0.023	0.009
Obs	320	271	262	252	132
Threshold	3%	3%	3%	3%	3%

Conclusions and Suggestions for Further Research

In this chapter I investigated empirically a mechanism through which institutions affect debt sustainability. Institutions affect debt sustainability directly through the quality of debt management, greater commitment to macroeconomic stability and

stricter incentive-compatibility constraints on government officials. My main contribution was to show explicitly the growth channel through which institutions interact with debt sustainability: changes in institutions lead to economic growth, which in turn provides the resources that allow countries to service their debts without hardship.

At least three issues from this analysis would benefit from further research. The first is the pattern whereby the CPIA and changes in the CPIA seem to be particularly (or only) relevant to low income countries. It would be interesting to investigate whether this is specifically due to the CPIA or whether this pattern reflects a more general insight about institutions (for example, it may suggest that a non-linear relationship between institutions and development).

The second issue is that of the relationship between debt, debt distress, and growth. Although here I offered some evidence that the effect of growth on debt distress is not caused by negative effects of debt on growth, further analysis is needed on the impact of debt and debt distress on growth.

Finally, even if I take my results literally—namely, that governments should pursue policies and reforms that would lead to an improvement in CPIA ratings to maximize their growth potential—I am left with the problem of priorities. The CPIA encompasses a broad range of policies and institutions, from debt management to education and environmental policies, to gender equality. In a world of constraints on the political ability of governments to pursue reforms, it would be critical to have a better understanding of which policies and institutions that are captured by the CPIA are especially relevant and should receive priority in a given country.

Annex Proofs

Proposition 1

Suppose that γ is such that it is incentive-compatible once the shock is realized. The incentive compatibility constraint for choosing technology A is given by:

$$q(1-q)p + (1-q)(\gamma p + (1-q)p) > (1-q)qp + q(\gamma p + qp)$$

Solving for γ, I can see that no feasible $\gamma \in (0,1)$ can satisfy the above incentive compatibility condition. Therefore, technology B is always chosen.

The incentive compatibility condition for the government not to appropriate the entire output once the shock is realized is given by $\gamma \geq 1-q$. Since voters provide the minimum transfers required to meet incentive compatibility, $\gamma = 1-q$.

The probability of default is simply the sum of the expected output in both periods, discounting the resources taken by the government, which cover the debt service or are retained by the government as rents.

Proposition 2

The incentive compatibility condition for choosing technology A is now given by

$$q(1-q)p + (1-q)(\gamma p + (1-q)p) > qp$$

This constraint is satisfied within the feasible range of γ and $\gamma \geq \frac{2q-1}{1-q}$. The incentive compatibility constraint for ensuring that the government does not retain the entire private output that may have been produced in the first period is given by $\gamma \geq q$. Comparing the two values for γ, I arrive at $\gamma = q$ for $0.667 < q < 0.618$. If q exceeds 2/3, no feasible γ are available. The probability of default is reduced because there are

now more funds, because of lower rental extraction by the government and higher growth.

Notes

1. IDA is the concessional lending arm of the World Bank.
2. The upper bound on q is needed for technical reasons.
3. Bond, Hoeffler and Temple note that it is sufficient to assume that i) $E(v_i \Delta x_{it}) = 0$; and ii) the process has been generating the per-capita GDP series for some time prior to the beginning of the sample period.
4. This effect has been referred to by Kaufmann, Kraay and Mastruzzi (2005) as the "growth halo effect." Although these authors argue that income halo effects are not sufficient to dismiss institutional measures as proxies for income levels, they admit that growth halo effects may be a source of bias.
5. Restricting our sample to those country-years where data on the change in the CPIA is available does not change the averages in Table 4.1 significantly.
6. The Paris Club is an informal group of official bilateral creditors that provide coordinated debt relief to debtor countries facing difficulties meeting their debt service payments (most often, those countries are already in default to Paris Club members).
7. The correlation between the two shock measures is very high (73%), and I use deviation from the overall average in the analysis of the effect on debt distress of being in a year during a growth episode, since this increases the number of data points available, and the deviation from last five years in the analysis that replaces GEYEAR with growth over the past five years, since deviations from overall growth are highly correlated with growth over the last five years. Using the deviation from last five years in the analysis with growth episodes reduces statistical significance marginally, but not the overall results (in particular, in no regression where GEYEAR was significant does it become insignificant with the different shock measure).

8. I used GEFF(a) instead of FRAC because substantially more data were available for GEFF(a).
9. This is partly by the construction of growth episodes, although it was a priori possible that sustained episodes started at higher rates than non-sustained episodes.
10. Using the Legislative Index of Electoral Competition, LIEC, does not change the results. A score of 6 or 7 in the EIEC or LIEC means that multiple parties compete and win seats in elections.
11. Using the one-step estimator would strengthen my findings.

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