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ESSAYS IN INSTITUTIONAL AND DEVELOPMENT ECONOMICS

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To Martin

Abstract

Paper 1: ***Island Status, Country Size and Institutional Quality in Former Colonies***

The purpose of this paper is to explore the effects of island status and country size on institutional quality, and to determine if these institutional effects can explain the relatively strong economic performance of islands and small countries. One of the main findings of this paper is that the relationship between island status and institutional quality is significantly positive, and that these results are robust to the inclusion of a number of control variables. Further, we find that country size is negatively related to institutional quality, which is in keeping with previous results. Finally, using an instrumental variable method we demonstrate that when Rule of Law is included in regressions on levels of per capita GDP, the positive effects of small country size and island status disappear. These results provide further support for our hypothesis that institutions account for these countries' relatively better economic performance.

Paper 2: ***Endogenous Institutional Change After Independence***

Independence from colonial rule was a key event for both political and economic reasons. We argue that newly-independent countries often inherited sub-optimal institutional arrangements, which the new regimes reacted to in very different ways. We present a model of endogenous changes in property rights institutions where an autocratic post-colonial elite faces a basic trade-off between stronger property rights, which increases the dividends from the modern sector, and weaker property rights that increases the elite's ability to appropriate resource rents. The model predicts that revenue-maximizing regimes in control of an abundance of resource rents and with insignificant interests in the modern sector will rationally install weak institutions of private property, a prediction which we argue is well in line with the experience of several developing countries.

Paper 3: ***Congo: The Prize of Predation***

The article analyzes the war against Mobutu (1996–97) and the more recent war (1998–) in the Democratic Republic of the Congo with particular attention to greed and grievance as motivating factors in these two wars. Whereas the authors' usage of the term 'greed' simply reflects the desire to gain control of natural resource rents, they model 'grievance' as deliberate institutional differences, implemented by the ruler, between the formal and informal sectors. On the basis of quantitative and qualitative evidence, the authors outline a model of a predatory conflict between a kleptocratic ruler and a group of potential predators within a given region. The potential predators choose between peaceful production and predation on the ruling elite, who control the country's natural resource rents. It is shown that institutional grievance between the formal and informal sectors, along with the relative strength of the ruler's defense, play a key role for the initiation of a war. This observation is used to explain the timing of the two wars analyzed in this article. The model also shows that once a war has commenced, the abundance of natural resources and the ruler's kleptocratic tendencies determine conflict intensity. This result is also well in line with experience from the most recent Congolese war.

Paper 4: ***The Determinants of Rural Child Labor: An Application to India***

There are several factors that may contribute to the decision to send a child to work, such as poverty, market imperfections and parental preferences. The aim of this paper is to determine empirically the relative importance of these diverse factors on the incidence of child labor in rural India. In order to examine several potentially influential factors separately, we outline a theoretical model of child labor in a peasant household based on the model presented in Bhalotra and Heady (2003) with modifications to allow for the child to participate in different types of labor. We then use the theoretical model to specify and estimate an empirical model of rural child labor participation. Our results indicate that parental education and household income appear to play the most important role in determining whether a child works, attends school or is idle. Market imperfections, on the other hand, only play an important role in determining whether the child participates in family labor.

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Heather Congdon Fors

Gothenburg, Sweden, June 2006

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Overview

The four papers in this thesis deal broadly with issues related to development economics, and are motivated by the fact that differences in standards of living across countries are enormous, with little evidence to indicate that the poorest countries will catch up with the richest countries in the foreseeable future.[1] The questions why such differences exist and why they continue to persist are ones that economic growth theory and development economics have continually tried to address, with varying success. Traditional neoclassical growth theory, with its focus on capital investment, has been unable to provide convincing explanations for the vast differences in national incomes and standards of living between rich and poor nations. The question becomes why some countries save and invest more in physical capital than others; a question to which the traditional models provide no answers.

In order to address differences in economic performance, some authors have added institutions to growth theory (Knack and Keefer, 1995; Hall and Jones, 1999). Institutions are generally defined as the formal and informal "rules" that both constrain the actions of and provide incentives for the different actors in an economy. These in turn affect both the economic decisions made by individuals and firms as well as the outcomes of these decisions. Therefore, good institutions encourage productive economic behavior, such as investment in physical and human capital, and have a positive effect on the productivity of all inputs to production. Bad institutions, on the other hand, encourage rent seeking and theft and have a negative effect on the productivity of all inputs to production.

The positive relationship between the general quality of institutions and per capita income is well documented in the empirical literature (see Rodrik et al (2004), for example), and attention has turned to identifying the factors that influence how institutions are formed and evolve. In much of the existing literature geography (Diamond, 1997; Herbst, 2000; Sachs, 2001) and the colonial experience (Sokoloff and Engerman, 2000; Acemoglu et al, 2001, 2002; Bertocchi and Canova, 2002; Lange, 2004) are thought to play key roles, and institutions are assumed to be highly persistent.[2] The purpose of the first

[1] Although a few countries have managed to achieve economic convergence with the wealthiest of nations, these examples have been limited to OECD countries and a small number of growth miracles.

[2] This is not to say that only former colonies have been analyzed in the literature; some research has focused on the historical explanations of institutional quality in Europe, for example (North, 1990; Acemoglu, Johnson and Robinson, 2005).

paper in this thesis, "*Island Status, Country Size and Institutional Quality in Former Colonies*", is to explore the effects of specific geographical characteristics (island status and country size) on institutional quality, and to determine if these institutional effects can explain the relatively strong economic performance of islands and small countries. One of the main findings of this paper is that the relationship between island status and institutional quality is significantly positive, and that these results are robust to the inclusion of a number of control variables. An interesting result is that absolute distance from the equator (measured in latitude degrees) has a significant effect on institutions in the case of non-islands, but not in the case of islands. Therefore, island status in and of itself appears to be an important geographical determinant of institutional quality. Finally, using an instrumental variable method we demonstrate that when our measure of institutional quality is included in regressions on levels of per capita GDP, the positive effects of small country size and island status disappear. These results provide further support for our hypothesis that institutions account for these countries' relatively better economic performance.

The paper "*Endogenous Institutional Change after Independence*" models the formation of institutions as an endogenous process affected by recent history, rather than something that is given by geography and deeper historical events. While we agree that institutions surely exhibit a degree of persistence, we argue that newly-independent countries often inherited sub-optimal institutional arrangements, which the new regimes reacted to in very different ways. In our model, an autocratic post-colonial elite faces a basic trade-off between appropriating rents from an easy rent sector (in most cases the natural resource sector) and growing the economy's industrial output. Greater natural resource abundance would provide a disincentive to invest in property rights, as appropriation of rents is assumed to be negatively related to the strength of property rights. We also take into account the options faced by the workers in the economy. There are two employment opportunities: the formal sector and the informal sector. The formal sector output is a positive function of property rights while the informal sector is unaffected by property rights. If property rights are weak, output will be lower in the formal sector and hence wages will be lower. This will in turn lower the number of workers who choose the formal sector over the informal sector. It is through this feedback mechanism that the possibility of a multiple equilibrium solution arises, with one solution being a disinvestment, poverty-trap solution and the other

being a growth solution.

The model predicts that revenue-maximizing regimes in control of an abundance of resource rents and with insignificant interests in the modern sector will rationally install weak institutions of private property, a prediction which we argue is well in line with the experience of several developing countries. This prediction is also in line with the existing literature on the observed "curse of natural resources" (see Sachs and Warner (2001), Gylfason (2001), and Woolcock et al (2001), for example). However, the model further predicts that when strong institutions of private property are in place prior to independence the resource curse will be diminished or even eliminated, which is in line with the empirical findings in Mehlum et al (2006). Finally, because investment in institutional quality is costly, the model demonstrates why some countries may be trapped in an equilibrium with weak institutions even when institutional investment could lead to an increase in the ruling elite's utility.

The third paper in this thesis, "*Congo: The Prize of Predation*", incorporates both institutions and natural resource abundance into a model of predatory conflict between a kleptocratic ruler and a group of potential predators within a given region. The model is then used to analyze the war against Mobutu (1996–97) and the more recent war (1998–03) in the Democratic Republic of the Congo. This paper is inspired by Collier and Hoeffler's (2004) empirically based distinction between greed and grievance as the two main motivations for civil wars. For our purposes the term 'greed' simply reflects the desire to gain control of natural resource rents, while 'grievance' takes the form of deliberate institutional differences, implemented by the ruler, between the formal and informal sectors. The potential predators in the model choose between peaceful production and predation on the ruling elite, who control the country's natural resource rents. The ruling elite choose between spending the available resource rents on investment in public utilities and private defense.

The model predicts that institutional grievance between the formal and informal sectors, along with the relative strength of the ruler's defense, play a key role for the initiation of a war, and are referred to as trigger factors. This observation is used to explain the timing of the two wars analyzed in this article. The model also shows that once a war has commenced, the abundance of natural resources and the ruler's kleptocratic tendencies determine conflict intensity. If the available pool of appropriable resource rents is large,

then there is a greater incentive to prolong the war, which may also be self-financing. Further, the more the ruling elite invests in private defense, the more likely it will be able to withstand predatory attacks. This result is also well in line with experience from the most recent Congolese war.

Another component that has been added to the traditional growth models is human capital (Romer, 1990; Aghion and Howitt, 1992), and the empirical evidence indicates that this addition explains a great deal of the differences in output between nations (see Mankiw et al (1992), for example). Therefore, an important question in development economics is why some countries invest more in human capital than others.

The final paper in this thesis, "*The Determinants of Rural Child Labor: An Application to India*", attempts to identify the microeconomic factors that influence a household's decision to send children to work rather than school. These factors range from poverty and market imperfections to parental preferences. The aim of the paper is to determine empirically the relative importance of these diverse factors on the incidence of child labor in rural India. In order to examine several potentially influential factors separately, we outline a theoretical model of child labor in a peasant household based on the model presented in Bhalotra and Heady (2003) with modifications to allow for the child to participate in different types of labor. We then use the theoretical model to specify and estimate an empirical model of rural child labor participation.

Our results indicate that parental education and household income play the most important role in determining whether a child works, attends school or is idle. Market imperfections, on the other hand, only play an important role in determining whether the child participates in family labor. Therefore, it may be possible to increase school attendance in the short- to medium-run through means of income redistribution. However, theoretical models have shown that the results of income redistribution on school attendance are ambiguous and depend on the mean income level of the economy (Rogers and Swinnerton, 2001; Ranjan, 2001). As a result, macroeconomic growth strategies that raise the level of income of the entire society are likely the best long-run policies for reducing child labor via household income. Further, education appears to have a dynastic effect where educational attainment leads to a virtuous circle, while the lack of education could lead to a poverty trap. Therefore, policies aimed at improving the quality and accessibility of schools may be quite successful in eliminating child labor in the long run.

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Island Status, Country Size and Institutional Quality in Former Colonies

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Abstract

The purpose of this paper is to explore the effects of island status and country size on institutional quality, and to determine if these institutional effects can explain the relatively strong economic performance of islands and small countries. One of the main findings of this paper is that the relationship between island status and institutional quality is significantly positive, and that these results are robust to the inclusion of a number of control variables. Further, we find that country size is negatively related to institutional quality, which is in keeping with previous results. Finally, using an instrumental variable method we demonstrate that when *Rule of Law* is included in regressions on levels of per capita GDP, the positive effects of small country size and island status disappear. These results provide further support for our hypothesis that institutions account for these countries' relatively better economic performance.

Keywords: islands, political institutions, economic institutions, rule of law, development.

JEL Codes: N40, O10

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1 Introduction

The purpose of this paper is to explore the effects of island status and country size on institutional quality, and to determine if these institutional effects can explain the relatively strong economic performance of islands and small countries. The positive relationship between the general quality of institutions and per capita income is well documented in the empirical literature (Hall and Jones, 1999; Acemoglu et al, 2001, 2002; Easterly and Levine, 2003; Rodrik et al, 2004) and as such, the effects of island status and country size on institutional quality are likely to be pertinent to the economic development of these countries.

The number of small states in the world has been increasing in recent decades, stimulating an interest among economists in the effects of country size and, to a lesser extent, island status on economic growth.[1] Interestingly, the conclusions reached in much of the existing theoretical and empirical literature regarding these effects tend to diverge. In the theoretical literature, small countries are thought to suffer from their small labor force, limited internal markets and high per capita costs of public goods provision. Islands are thought to face the disadvantages of isolation, remoteness and the correspondingly greater transportation costs that arise as a result. Therefore, the general conclusions of the theoretical literature are that small country size and island status act to impede economic growth. The empirical evidence indicates, however, that islands do not face a significant disadvantage in terms of economic development (Armstrong and Read, 2003) and that small countries may actually perform better economically than larger countries (Easterly and Kraay, 2000).

In this paper, we argue that islands and small countries exhibit significantly better institutional quality, and that this institutional effect may account for the divergence in the theoretical and empirical results discussed above. Support for this hypothesis is found in previous research that indicates that small country size and island status are beneficial to the development of democracy (Diamond and Tsalik, 1999; Clague et al, 2001; Srebrnik, 2004). There is even some emerging evidence that small countries (in terms of geographical area) score significantly better on the World Bank governance

[1] The issue of country size an island status is particularly relevant in the case of developing countries. According to the World Bank, there are currently 151 sovereign developing countries in the world. Of these, 40 have a population of 1.5 million or less, and 29 are islands with no shared borders. Further, islands constitute the majority of the small countries; 26 of the 40 countries with populations under 1.5 million are islands (World Bank, 2006a).

indicator *Rule of Law* than their larger counterparts (Hansson and Olsson, 2006).

The aims of the empirical analysis in this paper are as follows: first, the impact of island status and country size on institutional quality in former colonies is examined, drawing on previous theoretical and empirical research. We are interested in determining whether or not small countries and islands do in fact have stronger institutions on average. While there exists theoretical and empirical research that indicates that small country size and island status are positively related to democratic institutions, there is little research into the effect of country size and island status on economic institutions. This is particularly true in the case of islands. Therefore, one contribution of this paper is to establish whether or not small countries and islands have relatively better economic institutions. Second, we test to see whether the empirical results indicating that small countries and islands perform relatively better economically than their larger, continental counterparts can be explained by differences in institutional quality. To our knowledge there is no other study that has linked institutional quality to the relatively strong economic performance of islands and small countries. The focus on former colonies is in keeping in with much of the existing literature on the determinants of institutional quality, where the colonial experience is thought to play a key role (Sokoloff and Engerman, 2000; Acemoglu et al, 2001, 2002; Bertocchi and Canova, 2002; Lange, 2004).[2]

As many islands countries are small both in terms of population and geographical area, we believe that it is important to include both size and island status in the analysis simultaneously in order to rule out the possibility that islands perform better on measures of institutional quality due purely to their relatively small size.[3] Further, while country size is often measured in terms of population, there are also arguments for measuring it in terms of geographical area. Therefore, both measures of country size are included in the analysis. In addition, two different types of institutions are analyzed. The first is the Freedom House measure *Political Rights*, which serves as our measure of democracy. The second is the World Bank governance indicator *Rule of Law*, which serves as our measure of economic institutions. The reason for

[2] This is not to say that only former colonies have been analyzed in the literature; some research has focused on the historical explanations of institutional quality in Europe, for example (North, 1990; Acemoglu, Johnson and Robinson, 2005).

[3] Indeed, there is a tendency in the literature to focus on the specific case of small island developing states (SIDS), further confounding these two effects (see Brigulio (1995), for example).

examining two different measures of institutional quality is that while democracy is important in its own right, there is evidence that it is not as strongly related to economic development as other measures of institutions, such as *Rule of Law* (Barro, 1996; Rodrik et al, 2004).

One of the main findings of this paper is that the relationship between island status and institutional quality is significantly positive. Further, these results are robust to the inclusion of a number of control variables. In keeping with the results reported above, country size is negatively related to institutional quality. In the case of *Political Rights*, however, country size becomes insignificant when a control for island status is included in the regression. Therefore, country size appears to be less powerful in explaining *Political Rights* compared to *Rule of Law*. Further, using an instrumental variable method we demonstrate that when *Rule of Law* is included in regressions on levels of per capita GDP, the positive effects of small country size and island status disappear. These results provide further support for our hypothesis that institutional quality accounts for these countries' relatively better economic performance.

The rest of the paper is organized as follows. Section two provides an overview of the existing theoretical and empirical literature related to the effects of country size and island status on institutions and economic growth. The data and empirical model are presented in section 3, while the results of the empirical analysis are discussed in section 4. Section 5 concludes the paper.

2 Country size, islands and institutional quality

2.1 Country size

The idea that country size may be related to democracy is not new. The Greek philosophers Plato and Aristotle believed that a small population was essential for a well-functioning democracy. Such beliefs about the optimality of small population were also found in the works of later philosophers, including Montesquieu and Rousseau. As a result, most political scientists and economists interested in the effects of country size on democracy or economic growth measure country size in terms of population (see Diamond and Tsalik (1999), Easterly and Kraay (2000), Armstrong and Read (2000, 2002, 2003) and Knack and Azfar (2003), for example). In the case of democracy, a small population is thought to bring with it the advantage of homogeneity and greater participation in the democratic process on the part of the indi-

vidual citizens. In terms of economic growth, however, a small population has been thought to be detrimental. The Lewis model of industrialization, for example, assumes that the typical developing country has a large agricultural sector and a correspondingly large agricultural labor force (Lewis, 1954). These conditions are obviously not met by small countries. Countries with small populations are also thought to suffer from their small domestic markets and the resulting inability to take advantage of scale economies, as well as the reduced domestic competition and risk for monopolies that arises. Further, small countries may face difficulties in diversifying their output, leaving them more vulnerable to external economic shocks (Armstrong and Read, 2003). Finally, small countries may face a disadvantage in the provision of public goods, as a small population leads to a higher per capita cost of public goods. Therefore, models that attempt to explain country size as an endogenous choice variable tend to focus on the trade-off between the democratic advantages and the economic disadvantages of a small population (Alesina and Spolaore, 1997, 2003).

Another, much less common, means of measuring country size is area (Dahl and Tufte, 1973; Rigobon and Rodrik, 2005; Hansson and Olsson, 2006). In this case, country size is thought to affect the total cost (rather than per capita cost) of public goods provision. Hansson and Olsson (2006) argue that the diffusion of public goods (among which they include institutions such as rule of law) from the capital to the hinterland is more efficient in geographically small countries than in larger countries.[4] Therefore, it may not be the case that geographically small countries suffer from a significantly higher per capita cost of public goods if provision of public goods is significantly more expensive in geographically large countries. In terms of economic growth, however, geographic size is thought to have little impact. While land area may possibly act as a proxy for natural resource abundance, there is little evidence that area is correlated with measures of economic activity (Armstrong and Read, 2003).

While there is some theoretical and empirical evidence that country size in terms of area may be endogenous (Alesina and Spolaore, 1997, 2003), we would argue that this is not likely to be the case with former colonies. Sup-

[4]They further argue that countries with a centrally located capital are even better equipped to disseminate public goods throughout the country. This argument bears some similarity to the argument put forth by Herbst (2000), where the geographical attributes of a country play an important role in the capability of the state to effectively broadcast its power across the entire nation.

port for this assumption is found first and foremost in Africa, where borders are often considered to have been drawn in a somewhat arbitrary fashion (Herbst, 2000; Engelbert et al, 2002). Population, on the other hand, is more variable over time than area. Further, population is more likely to be directly related to the level of economic development, making it potentially difficult to distinguish the effects of population on institutional quality from the effects of income. Therefore, measuring country size in terms of area may have some advantages over population. It is difficult, however, to argue *a priori* for one measure of country size over the other. Therefore, we will test both measures separately in the remainder of this paper.[5]

2.2 Islands

The characteristics that are often assumed to set islands apart from non-islands are isolation and remoteness. Despite this, many researchers include countries such as Dominican Republic, Papua New Guinea and East Timor in the island category. Perhaps a stricter definition of an island is a country with no land borders. One advantage of this definition is that it makes it even more reasonable to assume that country size in area is exogenous.[6]

Baldicchino (2005) argues that island jurisdictions are better suited to the accumulation of social capital, making them more likely to develop into democracies and facilitating in their economic development. In terms of economic growth, small island countries are thought to face the disadvantage of increased transportation costs due to their geographic isolation, including potentially high internal transportation costs in the case of island archipelagoes (Armstrong and Read, 2003). Therefore, island status is, much like small size, thought to be an advantage in terms of political institutions, but a disadvantage in terms of economic growth.

2.3 Previous empirical results

There is growing empirical evidence that countries with small populations, and small island countries in particular, are more likely to be stable democracies than their large, continental counterparts (Hadenius, 1992; Stepan and Skach, 1993; Diamond and Tsalik, 1999; Clague et al, 2001, Srebrnik, 2004). The question that arises, however, is whether these results are driven by the fact that a small population is thought to have a positive effect on democracy,

[5] In our sample of former colonies, the correlation between area and population is 0.8499.

[6] One could of course argue that the size of islands is not fully exogenous, as there are island nations that consist of several small islands. We believe, however, that country size can be considered quite exogenous despite these exceptions.

or whether there is an additional advantage to island status not captured by size alone. Further, there is some evidence that the link between wealth and democracy is much weaker in small islands than in large countries, i.e. small islands are more likely to be democracies even when per capita GDP is low (Ott, 2000; Anckar, 2002).

Rigobon and Rodrik (2005) estimate the impact of population and area on democracy simultaneously and find that area has no effect, while population has a highly significant negative effect on democracy. Their estimates for the effect of population and area on rule of law show that both variables are negative and significant, but with a low overall effect compared to the other control variables. Hansson and Olsson (2006) find a robust negative relationship between rule of law and country size measured in terms of area. Overall, the results support the hypothesis that small country size is beneficial for institutional quality.

The empirical evidence on the effects of country size on economic growth run counter to the expected results, i.e. there is no great disadvantage associated with a small population (Armstrong and Read, 2003). In fact, Easterly and Kraay (2000) found that microstates perform better economically than larger countries, even after taking into account an array of control variables. Further, there does not seem to be an economic disadvantage of being an island (Armstrong and Read, 2003). We believe that the explanation for the divergence in the theoretical and empirical results lies in institutional quality, i.e. small countries and islands have stronger institutions than large countries and non-islands, accounting for the relatively better economic performance of these countries. This hypothesis will be explored in more detail in the remainder of the paper.

3 Data specification and general empirical model

Armstrong and Read (2003) and Rigobon and Rodrik (2005) distinguish between political institutions and economic institutions, where the former are generally measured in terms of a country's democratic system and political sovereignty. The definition of economic institutions, however, is less clear. Armstrong and Read are interested in economic institutions in terms of economic policy sovereignty, i.e. the extent to which a country can determine its own monetary, fiscal and trade policies, for example. Rigobon and Rodrik, on the other hand, do not explicitly define economic institutions, but measure them using the World Bank governance indicator *Rule of Law*, which measures

legal outcomes such as the likelihood of crime, the enforceability of contracts, and the effectiveness of the court system and the police (Kaufmann, Kraay and Mastruzzi, 2005). Other common measures of economic institutions used in empirical analysis are *Risk of Government Expropriation* (Acemoglu et al, 2001, 2002) and *Social Infrastructure* (Hall and Jones, 1999). There is some debate in the literature as to whether these measures can truly be called institutions (see Glaeser et al (2004), for example) and as such, these measures are sometimes referred to as structural policies. Despite this debate, measures such as *Rule of Law* continue to be used as indicators of institutional quality.

For the purpose of this paper, we will use the Freedom House measure *Political Rights* for 2004 as our measure of political institutions.[7] Political rights are measured based for example on how well the electoral process functions, the extent of political pluralism and participation, and how well the government functions (Freedom House, 2005). Our measure of economic institutional quality will be the World Bank governance indicator *Rule of Law* for 2004. Further, the paper focuses on former colonies, in keeping with much of the previous research. One reason for this is that former colonies are more likely to exhibit exogenously determined country size, as discussed in section 2 above. Further, the sample is restricted to former European colonies outside of continental Europe that were fully independent as of 2004. The reason for this is two-fold: first, our measure of political institutions (*Political Rights*) is only available for independent countries. Second, it is not clear whether politically dependent countries are able to independently choose the institutions they implement. The second point will be addressed in more detail in section 3.6 below. With these restrictions in mind, our main sample consists of 120 former colonies. Many of the countries included in the sample are very small, both in terms of population and area. As a result, many of these smallest countries are not included in cross-country regressions, often due to missing or unreliable data (this is especially true in the case of economic variables, such as per capita GDP).

The data for *Political Rights* and *Rule of Law* is available for all 120 countries. The original *Rule of Law* data runs from -2.5 to 2.5 and has been normalized for the purpose of this paper to run from 0 to 10, where 0 is

[7] Another measure of democracy commonly used in the literature is the Polity measure. This data is not available, however, for many of the smallest countries in the world. As a result, I find it preferable to use the Freedom House measure, which is highly correlated with the Polity measure (the correlation coefficient is 0.9067 for the 93 countries in the sample where both the Polity and the Freedom House measures are available).

the lowest score a country can achieve and 10 is the highest. The original *Political Rights* data runs from 1 to 7, where 1 is the highest score a country can achieve and 7 is the lowest. Therefore, we invert the *Political Rights* data in order to make the two measures of institutions more easily comparable.

Equation (1) summarizes the general empirical model employed in this paper:

$$Inst_i = \alpha_0 + \alpha_1 Island_i + \alpha_2 S_i + \alpha_3 X_i + \epsilon \quad (1)$$

where $Inst_i$ is a measure of institutional quality (in our case, *Political Rights* or *Rule of Law*) in country i and $Island_i$ is a dummy variable taking the value of one if the country is an island. For the purpose of this paper, only islands without land borders will be considered as islands.[8] S_i is logged country size measured in thousands of square kilometers or population in thousands (*LArea* and *LPop*), X_i is a vector of control variables, and ϵ is the normally distributed error term. The coefficients of prime interest are $\alpha_1$and α_2, with α_1 expected to be greater than zero and α_2 expected to be less than zero when the other control variables are taken into account.

4 Results

4.1 The basic model

Table 1 shows the correlation coefficients between our two measures of institutional quality, island status, our two measures of size, and absolute latitude. For the full sample, there is a negative correlation between country size and institutional quality, while island status is positively correlated with institutional quality. The correlation between country size and institutional quality in the sub-samples is weaker and is likely affected by outliers in terms of country size, such as Canada and the Untied States of America. Therefore, a multivariate analysis is likely to yield more interesting results.

Table 2 presents the regression results for political institutional quality (i.e. the dependent variable is *Political Rights*), controlling for absolute latitude (*Latitude*) and continent. The absolute value of latitude is meant to capture exogenous geographic factors that are thought to influence the formation of good institutions, such as the disease environment and the suitability of land for agriculture (Diamond, 1997; Herbst, 2000; Sachs, 2001). Continent dummies for Oceania, Africa, the Middle East and Latin America

[8] The only two exceptions to this are Cuba, which has a 29 km border with Guantanamo Bay, and Australia, which has no land borders but is considered to be a continent rather than an island.

Table 1: Pair-wise correlation coefficients for institutions, island, country size and latitude.

Full Sample (N=120)	Political Institutions	Economic Institutions	Island	Log Population	Log Area
Political Institutions	1.0000				
Economic Institutions	0.5868	1.0000			
Island	0.3677	0.4078	1.0000		
Log Population	-0.2779	-0.3897	-0.6260	1.0000	
Log Area	-0.2391	-0.3485	-0.7394	0.8499	1.0000
Absolute Latitude	0.0652 c)	0.3390	-0.0041 c)	0.1553 b)	0.1991 a)
Islands (N=33)					
Political Institutions	1.0000				
Economic Institutions	0.4451	1.0000			
Log Population	-0.3968 a)	-0.2329 c)		1.0000	
Log Area	-0.2238 c)	-0.3050 b)		0.8576	1.0000
Absolute Latitude	-0.0782 c)	-0.0185 c)		0.1928 c)	0.3396 b)
Non-Islands (N=87)					
Political Institutions	1.0000				
Economic Institutions	0.5371	1.0000			
Log Population	0.0695 c)	-0.0853 c)		1.0000	
Log Area	0.1825 b)	0.0434 c)		0.7030	1.0000
Absolute Latitude	0.1127 c)	0.4975		0.2032 b)	0.2812

Note: All correlation coefficients are significant at <1% except: a) significant at <5%, b) significant at <10% and c) not significant.

Table 2: Regression results for Political Rights in 2004

	Dependent Variable: Political Rights				
	(1)	(2)	(3)	(4)	(5)
Island	1.11***			1.01*	1.04*
	(0.38)			(0.54)	(0.46)
LArea		-0.14***		-0.02	
		[0.05]		(0.09)	
LPop			-0.15*		-0.03
			[0.08]		(0.10)
Latitude	-0.01	0.00	-0.00	-0.01	-0.01
	(0.02)	[0.02]	[0.02]	(0.02)	(0.02)
N	120	120	120	120	120
R-squared	0.4089	0.3910	0.3825	0.4093	0.4093

Note: Standard errors are given in (), robust standard errors are given in []. Estimated intercepts are omitted from the table. The superscripts ***/**/* indicate a p-value less than 0.01/0.05/0.10, respectively. Included continent dummies are Africa, Latin America (including Mexico), Middle East, Oceania and Neo-Europe (Australia, Canada, New Zealand and the United States of America).

(including Mexico) are included, as well as a separate category for Neo-Europe (Australia, Canada, New Zealand and the Untied States of America). Neo-European countries are given their own category because they tend to be outliers, both in terms of country size and in terms of colonial experience.[9]

In column (1) we present the regression results for the full sample, with *Island* as the variable of interest. The results indicate that island countries have significantly better political institutions, and that *Latitude* does not have a significant effect on political institutions. Replacing *Island* with *LArea* in column (2) and *LPop* in column (3), the results are virtually unchanged. In both cases, country size is significantly and negatively related to political institutions, with the relationship between *LArea* and *Political Rights* being more significant than the relationship between *LPop* and *Political Rights*. The effects of the different continents and *Latitude* are the same as in column (1). Therefore, island status has a positive effect on political institutions, while country size has the opposite effect. It is possible, however, that the positive effect of islands on political institutions is due to their generally small size (see Table 1), or that the negative effect of country size is driven by the islands in the sample. Therefore, we include both *Island* and *LArea* in column (4), and *Island* and *LPop* in column (5). In both cases, Island remains significantly and positively related to political institutions (although at a lower level of significance than in column (1)) while country size becomes insignificant.

Table 3 presents the regression results when the dependent variable is *Rule of Law*. Columns (1)-(3) show the results when *Island*, *LArea* and *LPop* are tested individually (including the control variables for continent and *Latitude*). As in Table 2, these three variables are all highly significant in their respective regressions, with *Island* exhibiting a positive relationship with *Rule of Law* and the size variables exhibiting a negative relationship. Further, *Latitude* is significantly and positively related to economic institutions in all three cases. In columns (4) and (5), *Island* and the respective size variables are included in the same regression. The results in column (4) show that *Island* becomes insignificant when *LArea* is included in the regression, while *LArea* remains highly significant and negative. In contrast, both *Island* and *LPop* remain significant when included in the same regression. In both (4) and (5), *Latitude* is significant and positive. The results in (4) seem to indicate that much of the significant relationship between Island and *Rule of Law* can

[9]Due to their outlier status, the Neo-European countries are sometimes dropped from empirical analysis (Bertocchi and Canova, 2002).

Table 3: Regression results for Rule of Law in 2004

	Dependent Variable: Rule of Law							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Island	1.43***			0.35	0.73**	2.86***	1.71***	2.15***
	(0.30)			(0.41)	(0.35)	(0.56)	(0.62)	(0.56)
LArea		-0.28***		-0.24***			-0.22***	
		(0.04)		(0.06)			(0.06)	
LPop			-0.34***		-0.26***			-0.26***
			(0.06)		(0.07)			(0.07)
Latitude	0.02*	0.03***	0.03**	0.03**	0.03**	0.04***	0.05***	0.05***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Isl x Lat						-0.09***	-0.08***	-0.08***
						(0.03)	(0.03)	(0.03)
N	120	120	120	120	120	120	120	120
R-squared	0.4665	0.5227	0.5047	0.5259	0.5236	0.5055	0.5578	0.5626

Note: Standard errors are given in (). Estimated intercepts are omitted from the table. The superscripts ***/**/* indicate a p-value less than 0.01/0.05/0.10, respectively. Included continent dummies are Africa, Latin America (including Mexico), Middle East, Oceania and Neo-Europe (Australia, Canada, New Zealand and the United States of America).

be explained by the fact the islands in the sample are geographically smaller than the non-islands. However, there are other factors that may come into play. In column (1), for example, *Latitude* is much less significant than in column (2). It is plausible that *Latitude* is not as relevant for islands as it is for non-islands if islands are less dependent on agriculture or if islands experience more moderate temperatures than their continental counterparts on the same latitude, for example. Further, there are relatively fewer islands in Africa, the continent where absolute latitude plays the most significant role in *Rule of Law*. Therefore, an interaction term between Island and Latitude (*Isl x Lat*) is included the regressions run in columns (1), (4) and (5). The results are presented in columns (6)-(8). In all three cases, *Isl x Lat* is significant and negative while *Latitude* is positive and significant, indicating that Latitude does not have the same effect on *Rule of Law* in islands as in non-islands. Further, comparing the results in column (4) with column (7), *Island* becomes highly significant and positive when *Isl x Lat* is included in the regression.

It is possible that the effect of size on *Rule of Law* also differs significantly between islands and non-islands. Therefore, regressions including the respective size variables are run on the island and non-island sub-samples. The results of these regressions are reported in table 4. Columns (1) and (2) present the regression results for the island sub-sample. In both cases, the size variable (*LArea* and *LPop*, respectively) is negative and significant, while *Latitude* is insignificant. In columns (3) and (4), the regression results for the non-island sample are reported. Again, both size variables are negative and significant, with *LPop* somewhat more significant than *LArea*. Further, *Latitude* is positive and significant in both cases. Therefore, the major difference between the islands and the non-islands in the sample lies in the fact that *Latitude* does not significantly effect *Rule of Law* in the case of islands.

Table 4: Regression results for Rule of Law in 2004, island and non-island samples

	Dependent Variable: Rule of Law			
	(1)	(2)	(3)	(4)
Island	Islands	Islands	Non-I	Non-I
LArea	-0.28**		-0.18**	
	(0.10)		(0.08)	
LPop		-0.33**		-0.23***
		(0.15)		(0.08)
Latitude	-0.03	-0.04	0.05***	0.05***
	(0.03)	(0.03)	(0.01)	(0.01)
N	33	33	87	87
R-squared	0.4802	0.4415	0.4768	0.4956

Note: Standard errors are given in (). Estimated intercepts are omitted from the table. The superscripts ***/**/* indicate a p-value less than 0.01/0.05/0.10, respectively. Included continent dummies are Africa, Latin America (including Mexico), Middle East, Oceania and Neo-Europe (Australia, Canada, New Zealand and the United States of America).

4.2 Institutions and economic performance

In this subsection, we test the hypothesis that the relatively better economic performance of islands and small countries can be explained by institutional quality. Table 5 presents the regression results for per capita GDP without controlling for institutions. In columns (1) - (3), the dependent variable is the natural logarithm of per capita GDP averaged over the years 1960 to 1995. In column (1), a dummy variable is included that takes the value one if a country is a small state (*Small State 1*). In order to qualify as a small state, a country must have had an average population of less than one million between the years 1960 and 1995.[10] The data for average GDP and small state status are taken from Easterly and Kraay (2000) and are available for 103 of the countries in our sample. In column (2), *Island* is included as an independent variable. Further, a dummy variable indicating whether a country's major exports are fuels (*ExpFuels*) is included in both regressions.[11] The results show that both *Small State 1* and *Island* are quite significant and

[10] In the case of countries that became independent after 1960, the first available year of data is used in the averages.

[11] This is in keeping with the regressions presented in Easterly and Kraay (2000) where a dummy variable indicating that a country was an oil producer was included.

Table 5: Regression results for Log per capita GDP from 1960 to 1995 and in 2004

Dependent Variable:	Log per capita GDP, Average 1960 - 1995			Log per capita GDP, 2004				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Small State 1	0.42***		0.28**					
	(0.12)		(0.14)					
Small State 2				0.40**				
				[0.18]				0.34
Small State 3					0.17			[0.22]
					[0.20]			
Island		0.43***	0.27*			0.35*	0.95**	0.80 a)
		[0.15]	(0.15)			[0.21]	[0.43]	[0.48]
ExpFuels	0.93***	0.90***	0.92***	0.87***	0.88***	0.89***	0.88***	0.86***
	(0.19)	[0.23]	(0.19)	[0.28]	[0.31]	[0.32]	[0.33]	[0.29]
Latitude	0.02***	0.02***	0.02***	0.03***	0.03***	0.03***	0.03***	0.04***
	(0.01)	[0.01]	(0.01)	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Isl x Lat							-0.04*	-0.04**
							[0.02]	[0.02]
N	103	103	103	120	120	120	120	120
R-squared	0.7246	0.7225	0.7338	0.5474	0.5267	0.5396	0.5571	0.5703

Note: Standard errors are given in (), robust standard errors are given in []. Estimated intercepts are omitted from the table. The superscripts ***/**/* indicate a p-value less than 0.01/0.05/0.10, respectively. Included continent dummies are Africa, Latin America (including Mexico), Middle East, Oceania and Neo-Europe (Australia, Canada, New Zealand and the United States of America). The superscript a) indicates a p-value = 0.100.

positively related to average per capita GDP. In column (3), *Small State 1* and *Island* are included in the same regression, and both variables are positive and significant.

In columns (4) - (8), the dependent variable is the natural logarithm of per capita GDP in 2004. This data is taken from the CIA World Fact Book and is available for all 120 countries in our sample. Two different measures of small state status are tested. The first includes all countries that were considered as small states according to *Small State 1* as well as countries not available in the Easterly and Kraay data with a population in 2004 of 1.5 million or less (*Small State 2*). The main reason that the upper population limit is extended to 1.5 million is that, due to population growth, many of the countries considered to be small states according to *Small State 1* had populations of well over 1 million in 2004. The second measure of small state status includes only countries with a population of one million or less as of 2004 (*Small State 3*). The results in columns (4) and (5) show that *Small State 2* is positively and significantly related to the level of per capita GDP in 2004, while *Small State 3* is insignificant. In columns (6) and (7), *Island* is included as an independent variable, with the additional independent variable *Isl x Lat* included in (7). In both cases, *Island* is positively and significantly related to the level of per capita GDP in 2004, while *Isl x Lat* is negative and significant in (7). In column (8), both *Small State 2* and *Island* are included as independent variables. While both variables are positive neither is significant, although *Island* has a p-value of 0.100. Finally, *ExpFuels* is very significantly and positively related to the level of per capita GDP in 2004 in all regressions.

Table 6 presents the two-stage least squares regression results for log per capita GDP where *Rule of Law* is included in the regression. The variables used to instrument for *Rule of Law* are *Island*, *Latitude*, *ExpFuels* and the various measures of country size (*LArea* or one of the small state dummies, depending on the particular regression), as well as *Isl x Lat* in columns (4) - (6). The dependent variable in columns (1) - (3) is log per capita GDP averaged over the years 1960 to 1995, whereas it is log per capita GDP in 2004 in columns (4) - (6).

In all columns except (3), *Rule of Law* is significantly and positively related to log per capita GDP, while the measures of island status and country size become insignificant. These results lend strong support to our hypothesis that the positive effects of country size and island status on levels of per capita

Table 6: Two-stage least squares regression results for Log per capita GDP from 1960 to 1995 and in 2004 controlling for Rule of Law in 2004

	Second Stage:					
Dependent Variable:	Log per capita GDP, Average 1960 -1995			Log per capita GDP, 2004		
	(1)	(2)	(3)	(4)	(5)	(6)
Rule of Law	0.21**	0.24*	0.11	0.31**	0.27**	0.26*
	(0.09)	[0.14]	(0.21)	[0.15]	[0.13]	[0.16]
Small State 1	0.16		0.22			
	(0.16)		(0.18)			
Small State 2				0.01		0.10
				[0.24]		[0.23]
Island		0.04	0.13		-0.03	-0.08
		[0.24]	(0.30)		[0.22]	[0.21]
ExpFuels	1.00***	1.00***	0.96***	0.87***	0.87***	0.86***
	(0.16)	[0.18]	(0.18)	[0.20]	[0.22]	[0.21]
Latitude	0.01*	0.01	0.02	0.02***	0.02***	0.02***
	(0.01)	[0.01]	(0.01)	[0.01]	[0.01]	[0.01]
N	103	103	103	120	120	120
R-squared	0.8177	0.8155	0.7947	0.7086	0.7025	0.7018
	First Stage:					
	Dependent Variable: Rule of Law					
Small State 1	0.62*		0.27			
	(0.36)		(0.41)			
Small State 2				0.86***		0.38
				(0.30)		(0.38)
ExpFuels	-0.38	-0.23	-0.25	0.02	0.13	0.10
	(0.47)	(0.47)	(0.47)	(0.41)	(0.40)	(0.40)
LArea		-0.19**	-0.16		-0.22***	-0.18**
		(0.08)	(0.09)		(0.06)	(0.07)
Island	1.32***	0.82*	0.80*	2.48***	1.70***	1.76***
	(0.38)	(0.48)	(0.48)	(0.57)	(0.63)	(0.63)
Latitude	0.04**	0.05***	0.04***	0.04***	0.05***	0.05***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Isl x Lat				-0.09***	-0.08***	-0.08***
				(0.03)	(0.03)	(0.03)
N	103	103	103	120	120	120
R-squared	0.5392	0.5513	0.5535	0.4958	0.5582	0.5629

Note: Standard errors are given in (), robust standard errors are given in []. Estimated intercepts are omitted from the table. The superscripts ***/**/* indicate a p-value less than 0.01/0.05/0.10, respectively. Included continent dummies are Africa, Latin America (including Mexico), Middle East, Oceania and Neo-Europe (Australia, Canada, New Zealand and the United States of America).

GDP are due to the relatively stronger institutional quality in these countries.

4.3 Robustness checks

In this subsection, the robustness of the relationship between island status, country size and institutional quality is investigated.

4.3.1 Trade openness

The correlation between country size and trade openness in our sample (where trade openness is measured as imports plus exports as a percentage of GDP) is between -0.50 and -0.54 (when country size is measured by *LArea* and *LPop*, respectively). This is hardly surprising, as small countries do not have access to large internal markets. As a result, many small developing countries have followed markedly different development strategies than their larger counterparts. During the late 1950s to mid-1980s, developing countries were encouraged to limit both international trade and the establishment of multinational companies within their borders, based in part on the infant industry argument. These strategies were not feasible for small developing countries, as their size often necessitated extensive participation in international trade (Lingle and Wickman, 1999).[12]

It is plausible, then, that some of the effect of country size on institutional quality is a result of trade openness. Lingle and Wickman (1999) argue, for example, that increasing trade liberalization and the free movement of capital are forcing countries to compete with one another on the basis of their economic institutions. One empirical study of the relationship between trade openness and institutions (measured in terms of corruption) is found in Wei (2000). Wei argues that trade openness can be divided into "natural openness" and "residual openness". A country's level of natural openness depends on population size, remoteness, the language spoken by the majority, and geographical factors, such as the length of the coast and whether the country is an island or landlocked. He finds that natural openness is significantly negatively related to corruption, while the effect of residual openness is insignificant.

One shortcoming of Wei's analysis is that the data on corruption for small countries (and particularly, small islands) is often missing. Knack and Azfar (2003) argue that this results in a sample selection bias in favor of small

[12]Lingle and Wickman (1999) argue that the small open economies (particularly city-states, such as Hong Kong and Singapore) have performed better economically than countries that followed the UN development strategies, due to the former's integration in world markets. Further, the establishment of multinational corporations in city-states is thought to have greatly facilitated the transfer of technology from developed countries.

countries, as corruption data has typically been available only for relatively well-governed small countries. Using an expanded data set, they argue that the relationship between trade openness and corruption all but disappears.

Despite the findings of Knack and Azfar, the arguments presented by Lingle and Wickman (1999) suggest that there may be a positive relationship between trade openness and institutional quality, especially in the case of small countries. Congdon Fors and Olsson (2005) develop a model of endogenous institutional investment where a thriving modern sector provides the ruling elite with the incentive to invest in property rights institutions. While this model assumes a closed economy, one could extend the analysis to include the export sector. If countries that are more open have a greater share of their economic activity in the modern sector, they would face a greater incentive to invest in their institutions. However, the model also predicts that abundant natural resource rents have a potentially detrimental effect on institutional quality. Therefore, if a country's trade is dominated by natural resources, then openness could have a negative effect on institutional quality. Finally, the preceding arguments suggest that trade openness may be more relevant for economic institutions than political institutions.

Table 7 presents the regression results for *Political Rights* when the natural logarithm of trade openness (*LOpen*) is included as an independent variable, along with dummy variables indicating whether a country's major exports are non-fuel primary products (*ExpNonF*) or fuels (*ExpFuels*).[13] The data for *ExpNonF* and *ExpFuels* is available for all 120 countries in the sample, while *LOpen* is only available for 101 countries. The results indicate that *LOpen* does not have a significant effect on political institutions, while *ExpNonF* and *ExpFuels* are significantly and negatively related to political institutions. However, when trade openness and major export categories are included in the same regression, only *ExpFuels* remains significant. Further, *Island* remains positive and significant in all cases. These results are not altered by the inclusion of the size variables.

[13] As mentioned above, openness is measured as exports plus imports as a percentage of GDP. This measure is employed because the effect of trade volume relative to total GDP on institutional quality is the relationship of interest.

Table 7: Regression results for Political Rights in 2004, controlling for trade openness and major export category

	Dependent Variable: Political Rights				
	(1)	(2)	(3)	(4)	(5)
LOpen	0.11		0.17	0.42	0.39
	[0.35]		[0.34]	[0.36]	[0.38]
ExpNonF		-0.84**	-0.46	-0.59*	-0.46
		(0.33)	[0.36]	[0.35]	[0.36]
ExpFuels		-1.34**	-1.29***	-1.56***	-1.36***
		(0.54)	[0.42]	[0.48]	[0.43]
Island	1.28***	0.92**	1.18***	2.01***	1.50***
	[0.36]	(0.37)	[0.35]	[0.51]	[0.43]
LArea				0.21**	
				[0.10]	
LPop					0.14
					[0.11]
Latitude	-0.00	-0.01	-0.00	-0.01	-0.00
	[0.02]	(0.02)	[0.02]	[0.02]	[0.02]
N	101	120	101	101	101
R-squared	0.4198	0.4572	0.4533	0.4764	0.4616

Note: Standard errors are given in (), robust standard errors are given in []. Estimated intercepts are omitted from the table. The superscripts ***/**/* indicate a p-value less than 0.01/0.05/0.10, respectively. Included continent dummies are Africa, Latin America (including Mexico), Middle East, Oceania and Neo-Europe (Australia, Canada, New Zealand and the United States of America).

The results in table 7 indicate that trade openness does not have a significant effect on political institutions. Exports of non-fuel primary products and fuels, on the other hand, have a negative effect on *Political Rights*, with the latter category exhibiting the greatest effect. Further, *Island* remains positive significant in all 5 of the regressions. Perhaps the most surprising result is that *LArea* becomes positive and significant in (4), although this may be related to the fact that the 19 countries with missing observations for *LOpen* are geographically much smaller on average than the countries for which *LOpen* is available.[14]

Table 8 presents the regression results for *Rule of Law* when *LOpen*, *ExpNonF* and *ExpFuels* are included as independent variables. *LOpen* and *Island*

[14]The average value of *LArea* for the countries missing *LOpen* is 1.94 (with a standard deviation of 3.09). For countries where *LOpen* is available, the corresponding figure is 4.74 (with a standard deviation of 2.67).

Table 8: Regression results for Rule of Law in 2004, controlling for trade openness and major export category

	Dependent Variable: Rule of Law							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LOpen	0.59**	0.51*			0.65**	0.55**		
	(0.25)	(0.27)			(0.25)	(0.27)		
ExpNonF			-0.45*	-0.57**	-0.42	-0.45*		
			(0.26)	(0.26)	(0.26)	(0.25)		
ExpFuels			-0.07	-0.24	-0.63	-0.64		
			(0.41)	(0.40)	(0.41)	(0.40)		
Island	1.53**	1.62***	1.51**	1.80***	1.43**	1.37**	1.48**	1.58**
	(0.64)	(0.61)	(0.63)	(0.58)	(0.65)	(0.62)	(0.66)	(0.62)
LArea	-0.09		-0.20***		-0.05		-0.15**	
	(0.07)		(0.06)		(0.07)		(0.07)	
LPop		-0.12		-0.25***		-0.11		-0.20**
		(0.08)		(0.07)		(0.08)		(0.08)
Latitude	0.05***	0.05***	0.04***	0.04***	0.04***	0.04***	0.05***	0.05***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Isl x Lat	-0.05*	-0.05*	-0.06**	-0.07**	-0.04	-0.04	-0.05	-0.05
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
N	101	101	120	120	101	101	101	101
R-squared	0.5932	0.5951	0.5700	0.5816	0.6101	0.6152	0.5686	0.5790

Note: Standard errors are given in (). Estimated intercepts are omitted from the table. The superscripts ***/**/* indicate a p-value less than 0.01/0.05/0.10, respectively. Included continent dummies are Africa, Latin America (including Mexico), Middle East, Oceania and Neo-Europe (Australia, Canada, New Zealand and the United States of America).

are both positive and significant in columns (1) and (2), while the size measures (*LArea* and *LPop*, respectively) become insignificant. *ExpNonF* and *ExpFuels* replace *LOpen* in columns (3) and (4). In both cases, *ExpNonF* is negative and significant while *ExpFuels* is negative and insignificant. *Island* remains positive and significant in both cases, while *LArea* and *LPop* are significant and negative in (3) and (4), respectively. When *LOpen* is included together with *ExpNonF* and *ExpFuels*, *LOpen* and *Island* remain positive and significant, while the size measures (*LArea* and *LPop*, respectively) are insignificant. *ExpNonF* is insignificant in (5) and negative and significant in (6), while *ExpFuels* is insignificant in both cases.

In contrast to table 7, the results in table 8 indicate that trade openness has a significant and positive effect on economic institutions. This is in keeping with the fact that the arguments for a positive effect of openness on institutions listed above were more relevant for economic institutions than political institutions. Further, the inclusion of *LOpen* in the regressions renders country size insignificant, while *Island* remains significant in all cases. The results in columns (7) and (8) indicate, however, that this is not due to missing variables as country size remains significant in the smaller sample when *LOpen* is not included in the regression.

Exports of non-fuel primary products has a significantly negative effect on *Rule of Law* (except in (5)), whereas exports of fuels do not have a significant effect on economic institutions. The latter result is somewhat surprising, given the significance of fuel exports in political institutions. Part of the explanation may have to do with the fact that fuel exporting countries tend to have higher GDP per capita than the other countries in the sample, as can be seen in table 9. Therefore, the positive income effect of fuels may offset the potentially negative effect on economic institutions. Similarly, the positive effect of *LOpen* on *Rule of Law* may be due in part to the positive effect of openness on per capita GDP. Exports of non-fuel primary products, on the other hand, are negatively related to per capita GDP, which may account for some of the negative effect of *ExpNonF* on *Rule of Law*.

Rigobon and Rodrik (2005) use a method known as identification through heteroskedasticity to control for the endogeneity of trade openness in per capita GDP. Their results show that trade openness has a negative effect on per capita GDP, while it has a significant positive effect of *Rule of Law* and negative effect on democracy. These results lends some support to our results that trade openness has a positive effect on economic institutions.

Table 9: Regression results for Log per capita GDP in 2004

	Dependent Variable: Log per capita GDP, 2004		
	(1)	(2)	(3)
LOpen	0.53***		0.49***
	[0.13]		(0.13)
ExpNonF		-0.29**	-0.27*
		[0.14]	(0.14)
ExpFuels		0.75**	0.45*
		[0.35]	(0.24)
Latitude	0.03***	0.03***	0.03***
	[0.01]	[0.01]	(0.01)
N	101	120	101
R-squared	0.6062	0.5376	0.6449

Note: Standard errors are given in (), robust standard errors are given in []. Estimated intercepts are omitted from the table. The superscripts ***/**/* indicate a p-value less than 0.01/0.05/0.10, respectively. Included continent dummies are Africa, Latin America (including Mexico), Middle East, Oceania and Neo-Europe (Australia, Canada, New Zealand and the United States of America).

Table 10: Regression results for Rule of Law and Political Rights in 2004 controlling for vulnerability

Dependent Variable:	Rule of Law			Political Rights
	(1)	(2)	(3)	(4)
Vuln	3.02**	2.45	1.49	-0.35
	(1.24)	(1.56)	(1.67)	[1.52]
Island	2.03***	1.76**	1.67**	1.04**
	(0.68)	(0.82)	(0.73)	[0.49]
LArea		-0.06		
		(0.10)		
LPop			-0.17	
			(0.12)	
Latitude	0.04***	0.04***	0.04**	-0.02
	(0.02)	(0.02)	(0.02)	[0.02]
Isl x Lat	-0.06	-0.05	-0.05	
	(0.04)	(0.04)	(0.04)	
N	80	80	80	80
R-squared	0.6081	0.6102	0.6183	0.4270

Note: Standard errors are given in (), robust standard errors are given in []. Estimated intercepts are omitted from the table. The superscripts ***/**/* indicate a p-value less than 0.01/0.05/0.10, respectively. Included continent dummies are Africa, Latin America (including Mexico), Middle East, Oceania and Neo-Europe (Australia, Canada, New Zealand and the United States of America).

4.3.2 Vulnerability

Small countries are often considered to be more vulnerable than large countries due to their greater exposure to exogenous shocks (Briguglio, 1995). Such exogenous shocks are generally thought to be economic in nature, although political and environmental shocks also play a role. Easterly and Kraay (2000) show, for example, that small countries have greater output volatility and a greater volatility of terms of trade shocks than the large countries in their sample. They explain this based on the fact that trade accounts for a larger proportion of GDP in small countries, and that small countries are less able to diversify their output and their export markets. In terms of politics, small countries are thought to be vulnerable to external political pressures from large countries, and hence constrained in their ability to formulate and implement independent foreign policy. This is in turn is partially due to the fact that small countries face difficulty in maintaining credible domestic defence, limiting their strategic options (Armstrong and Read, 2003). Finally, small countries tend to be more vulnerable to environmental shocks in the form of natural disasters, due in part to the fact that many small countries are located in geographic areas where hurricanes and typhoons are common. Indeed, low-lying islands are especially vulnerable to storms and rising sea-levels resulting from climate change (Armstrong and Read, 2003).[15]

An early attempt to measure vulnerability was made by Briguglio (1995). His Vulnerability Index uses economic measures of vulnerability that take into account trade openness, transport costs as a share of trade, and the cost of natural disasters. In table 10, Briguglio's Vulnerability Index (*Vuln*) is included as an independent variable in the *Rule of Law* and *Political Rights* regressions. In columns (1) - (3), *Vuln* is included as an explanatory variable for *Rule of Law*. *Vuln* is only significant in (1), whereas *Island* and *Latitude* are positive and significant in all cases. In column (4), *Vuln* is included as an independent variable in the *Political Rights* regression, and is found to be insignificant. Therefore, the effect of vulnerability on *Rule of Law* and *Political Rights* is nearly identical to the effect of trade openness on these institutions. This is perhaps unsurprising, given the high correlation between *Vuln* and *LOpen* (0.642 for 75 observations).

[15] An extreme example is the tiny island nation Tuvalu, located in the South Pacific. The tides have been 1.5 meters higher than average this year, and there are growing fears that the islands of the archipelago will become uninhabitable in the near future. The country's Prime Minister, Maatia Toafa, has suggested that a possible solution is the resettlement of the entire population in Australia and New Zealand (*Nature*, 2006).

While the Vulnerability Index is an interesting concept, it is quite sensitive to specification, as the reliance on economic indicators and the large role that trade plays in the index may mean that it is mis-specified. Indeed, Armstrong and Read (2002) find that the Vulnerability Index actually has a significant and *positive* effect on the long-run economic growth performance of small states, which runs counter to the intuition behind the index. Therefore, it is difficult to ascertain whether the effect of vulnerability on institutions stems from the fact that vulnerability forces countries to adapt stronger institutions to help offset shocks, or whether it stems from the positive effects of trade openness captured by the Vulnerability Index.[16]

4.3.3 Colonial history

Much of the previous research into the determinants of institutional quality in former colonies has focused on the extent to which Europeans were able to establish settlements in the colonies. Acemoglu, Johnson and Robinson (henceforth AJR) (2001) focus on the effect of settler mortality on institutions, and argue that in former colonies where settler mortality was high, Europeans did not settle but rather implemented extractive institutions. In a subsequent paper (AJR, 2002), they use the log of population density in 1500 as an instrument for institutional quality, arguing that countries with a high population density were less conducive to European settlement and were likely to have certain institutions in place already that could be used for extractive purposes. Countries with low population density, on the other hand, were more conducive to European settlement. Further, it was not as straightforward to extract resources from countries with a low population density, as the requisite infrastructure was often weak or nonexistent.

Another factor that may influence institutional quality is the identity of the last colonizing power. The empirical evidence indicates that former British colonies exhibit better economic development after independence (Grier, 1999) and are generally more democratic than other former colonies (Clague et al, 2001).

Table 11 presents the regression results for *Political Rights* when historical controls are included as independent variables. The log of settler mortality (*LMort*) is included in column (1) and is insignificant. In column (2), log population density in 1500 (*LPopDen*) is included as an independent variable and is found to be negative and significant. Turning to the identity of

[16] A regression including both *Vuln* and *LOpen* as independent variables renders both variables insignificant for both measure of institutions.

Table 11: Regression results for Political Rights in 2004 including historical controls

	Dependent Variable: Political Rights				
	(1)	(2)	(3)	(4)	(5)
LMort	0.03				
	[0.22]				
LPopDen		-0.30**			
		[0.14]			
Portugal			1.21*		0.93
			(0.64)		(0.64)
France				-0.95**	-0.82**
				(0.40)	(0.41)
Island	1.05*	0.94*	1.06***	1.04***	1.01***
	[0.55]	[0.48]	(0.38)	(0.38)	(0.37)
Latitude	0.01	-0.01	-0.01	-0.01	-0.01
	[0.02]	[0.02]	(0.02)	(0.02)	(0.02)
N	77	94	120	120	120
R-squared	0.4336	0.3997	0.4273	0.4368	0.4473

Note: Standard errors are given in (), robust standard errors are given in []. Estimated intercepts are omitted from the table. The superscripts ***/**/* indicate a p-value less than 0.01/0.05/0.10, respectively. Included continent dummies are Africa, Latin America (including Mexico), Middle East, Oceania and Neo-Europe (Australia, Canada, New Zealand and the United States of America).

Table 12: Regression results for Rule of Law in 2004 including historical controls

	Dependent Variable: Rule of Law					
	(1)	(2)	(3)	(4)	(5)	(6)
LMort	-0.28*	-0.27*				
	(0.16)	(0.16)				
LPopDen			-0.23**	-0.13		
			(0.11)	(0.11)		
UK+Neo					0.53**	0.58**
					(0.26)	(0.25)
Island	2.58***	3.08***	1.62*	2.34***	1.51**	1.85***
	(0.90)	(0.84)	(0.92)	(0.82)	(0.62)	(0.57)
LArea	-0.17*		-0.22***		-0.20***	
	(0.09)		(0.08)		(0.06)	
LPop		-0.17*		-0.24**		-0.24***
		(0.10)		(0.09)		(0.07)
Latitude	0.04**	0.04**	0.05***	0.04***	0.05***	0.04***
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Isl x Lat	-0.08*	-0.09**	-0.06	-0.09*	-0.07**	-0.08***
	(0.04)	(0.04)	(0.05)	(0.04)	(0.03)	(0.03)
N	77	77	94	94	120	120
R-squared	0.6484	0.6439	0.5780	0.5745	0.5739	0.5823

Note: Standard errors are given in (). Estimated intercepts are omitted from the table. The superscripts ***/**/* indicate a p-value less than 0.01/0.05/0.10, respectively. Included continent dummies are Africa, Latin America (including Mexico), Middle East, Oceania and Neo-Europe (Australia, Canada, New Zealand and the United States of America).

the last colonizing power, five dummy variables were constructed: *Portugal*, *Spain*, *France*, *Belgium*, UK or Neo-Europe (*UK+Neo*), and *Other*. Only *Portugal* and *France* were significantly related to *Political Rights* when the colonial dummies were included separately in the regression. Regardless of the historical controls included in the regressions, *Island* remains positive and significant in all cases, indicating that *LMort*, *LPopDen* and the identity of the last colonizing power do not explain the significance of *Island* in *Political Rights*.

The effects of the various historical control variables on *Rule of Law* are reported in table 12. *LMort* is significantly and negatively related to *Rule of Law*, while *LPopDen* is negative and significant in (3) and insignificant in (4). *UK+Neo* is the only colonial variable to exert a significant effect on *Rule of Law* when the identity of the last colonizing power is taken into account, with the relationship being a positive one. In all of the above cases, both the size variables and *Island* remain significant, the former negatively so and the latter positively so. Again, the various historical controls do not explain the significant positive effect of *Island* on *Rule of Law*. Further, while both *LMort* and *LPopDen* are popular instrumental variables in the institutions literature, they are somewhat restrictive when the variable of interest is *Island*. The data for *LMort* is only available for 10 of the islands in the sample, for example, while the *LPopDen* data is available for 17 (compared to 33 for the full sample). In the case of *LPopDen*, many of the small Caribbean islands have been assigned the same population density as Dominican Republic, making the data availability for islands somewhat inflated.

While the historical variables listed above are no doubt important factors in explaining institutional quality, they may be somewhat too broad to capture important differences between countries with similar mortality rates, population densities, or former colonizing power. Rather, the manner in which the former colony was administered by the colonial powers may prove to be a significant factor in institutional quality. For example, Lange (2004) has demonstrated that the extent of indirect rule in 1955 is significantly and negatively related to *Rule of Law* and an average of *Political Rights* in 33 former British colonies.[17] It is plausible that smaller countries were easier to administer from a bureaucratic point of view and that as a result, the transplantation of institutions from the colonizer to the colony was much more effective in

[17] Lange uses *Rule of Law* data from 1998. The average democracy scores are calculated for the years 1972 to 2000.

smaller countries than in larger countries. In the case of islands, administration may have been further facilitated by the fact that borders were often pre-determined by geography, and as such were not a point of contention.

Table 13 reports the regression results for *Rule of Law* and *Political Rights* when *Indirect* is included as an independent variable. In column (1), *Island* is also included as an independent variable, but neither of the size variables are included. *Indirect* is negatively and significantly related to *Rule of Law*, while *Island* becomes insignificant. In column (2), the size variable *LArea* is included in the regression. In this case, the relationship between *Indirect* and *Rule of Law* is negative and nearly significant (p-value=0.1000), while both *Island* and *LArea* are insignificant. In column (3), *LArea* is replaced with *LPop*. The relationship between *Indirect* and *Rule of Law* is insignificant in this case, as is the relationship between *LPop* and *Rule of Law*. *Island*, on the other hand, becomes positive and significant. In all three of the previous regressions, *Latitude* was insignificant. Finally, column (4) presents the regression results for *Political Rights* when *Indirect* and *Island* are included as independent variables. The results show that neither *Indirect* nor *Island* are significantly related to *Political Rights*. In fact, the only significant variables in this regression are the unreported control for Latin America and the constant term.

The results in table 13 indicate that the extent of indirect rule may partially explain the better performance of island countries, at least in terms of *Rule of Law*. As table A3 in the data appendix shows, all islands in the sample were ruled directly except Fiji and Solomon Islands, both of which are located on the opposite side of the globe in relation to Britain. African countries tend to exhibit a greater extent of indirect rule, while all Latin American countries were ruled directly, island or not. Indeed, several factors seem to play a role in determining the extent of indirect rule. While the results in table 13 are interesting, it is difficult to draw definite conclusions based on such as small sample. Further, the sample is restricted to former British colonies that were still under British rule in 1955. Therefore, more research into the extent of indirect rule in a broader range of colonies may be a fruitful line of future research.

4.3.4 Dependent versus independent states

So far, the analysis has been restricted to former colonies that were independent as of 2004. There is, however, *Rule of Law* data available for a number of politically dependent territories. Therefore, it may be of inter-

Table 13: Regression results for Rule of Law and Political Rights in 2004 controlling for the extent of indirect rule in 1955

Dependent Variable:	Rule of Law			Political Rights
	(1)	(2)	(3)	(4)
Indirect	-0.03**	-0.02[a)]	-0.01	-0.01
	(0.01)	(0.01)	(0.02)	(0.02)
Island	1.16	0.55	1.50*	0.78
	(0.80)	(0.87)	(0.81)	(1.02)
LArea		-0.26		
		(0.16)		
LPop			-0.35	
			(0.23)	
Latitude	-0.01	-0.00	-0.01	-0.01
	(0.03)	(0.03)	(0.03)	(0.04)
N	31	31	31	31
R-squared	0.5398	0.5853	0.5828	0.3574

Note: Standard errors are given in (). Estimated intercepts are omitted from the table. The superscripts ***/**/* indicate a p-value less than 0.01/0.05/0.10, respectively and a) indicates p-value=0.100. Included continent dummies are Africa, Latin America (including Mexico), Middle East, Oceania and Neo-Europe (Australia, Canada, New Zealand and the United States of America).

Table 14: Regression results for Rule of Law and Political Rights in 2004 controlling for dependent status and years of independence

Dependent Variable:	Rule of Law						Political Rights
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent	2.25***	1.48***	1.77***				
	(0.51)	(0.51)	(0.49)				
Years Indep				-0.01**	-0.01**	-0.01**	-0.003
				[0.003]	(0.003)	(0.003)	[0.004]
Island	2.72***	1.62***	2.07***	2.23***	1.24**	1.78***	0.96**
	(0.55)	(0.57)	(0.53)	[0.59]	(0.57)	(0.55)	[0.45]
LArea		-0.23***			-0.25***		
		(0.06)			(0.06)		
LPop			-0.27***			-0.27***	
			(0.06)			(0.07)	
Latitude	0.04***	0.05***	0.05***	0.05***	0.05***	0.05***	-0.00
	(0.01)	(0.01)	(0.01)	[0.01]	(0.01)	(0.01)	[0.02]
Isl x Lat	-0.09***	-0.08***	-0.09***	-0.08***	-0.07***	-0.08***	
	(0.03)	(0.03)	(0.03)	[0.02]	(0.03)	(0.03)	
N	127	127	127	127	127	127	120
R-squared	0.5501	0.6099	0.6089	0.5297	0.5998	0.5796	0.4120

Note: Standard errors are given in (), robust standard errors are given in []. Estimated intercepts are omitted from the table. The superscripts ***/**/* indicate a p-value less than 0.01/0.05/0.10, respectively. Included continent dummies are Africa, Latin America (including Mexico), Middle East, Oceania and Neo-Europe (Australia, Canada, New Zealand and the United States of America).

est to test whether dependent territories have stronger or weaker economic institutions than independent countries. For example, it might be the case that territories with strong institutions are more likely to successfully gain their independence, while territories with weak institutions are more likely to remain dependents of the colonial ruler. On the other hand, colonial powers may have a greater incentive to hold on to colonies that score highly on *Rule of Law* if these territories perform well economically as a result. Further, dependent territories may exhibit stronger economic institutions as a direct result of their dependent status, i.e. the close connection with the colonial power may lead to better economic institutions. Indeed, Armstrong and Read (2000) find that dependent territories perform better economically than sovereign microstates. Focusing exclusively on islands, Bertram (2004) also finds that dependent islands perform better economically than independent islands.

Table 14 presents the regression results for *Rule of Law* when seven dependent territories (Bermuda, Cayman Islands, French Guiana, Macao, Martinique, Hong Kong and Puerto Rico) are included and controlled for in the sample. In columns (1) - (3), a dummy variable indicating dependency status (*Dependent*) is included in the analysis. In all three regressions, *Dependent* is positively and significantly related to *Rule of Law*, indicating that the depended territories in the sample have significantly better economic institutions than the independent countries. In columns (4) - (6), a variable measuring the number of years a country has been independent (*Years Indep*) is included as an independent variable. The results show that *Years Indep* is negatively and significantly related to *Rule of Law*, i.e. countries that have been independent for a shorter period of time have significantly better economic institutions than countries that have been independent for a long period of time. Column (7) reports the regression results for *Political Rights* when *Years Indep* is included as an independent variable, and show that *Years Indep* has no significant effect on political institutions. Taken together, the results in table 14 indicate that late colonial rule is good for economic institutions, while it has no effect on political institutions. One hypothesis is that late colonial rule brought with it closer trade ties, which in turn was beneficial for economic institutions (see 4.3.1, for example).

4.3.5 Social capital and identity

A concept that has become increasingly popular in the social sciences literature is social capital and its effect on economic development and institutions. A seminal contribution to this field is Putnam (1993), where it is argued that

social capital is positively related to economic growth and government performance in Italy. Using cross-country data, Knack and Keefer (1997) find that social capital is positively related to economic performance, and that there is a significant positive relationship between social capital and formal institutions. Djankov et al (2003) argue that countries with greater amounts of civic capital (which in addition to social capital includes culture, ethnic heterogeneity and other historical factors) are able to better minimize the aggregate social costs of disorder and dictatorship, and therefore have a greater freedom in choosing and implementing optimal formal institutions.

The definition and measurement of social capital differs between Putnam (1993) and Knack and Keefer (1997); Putnam's measure of social capital is membership in formal groups (also referred to as associational activity), while Knack and Keefer measure social capital in terms of the level of trust and the strength of norms of civic cooperation in a society. Perhaps the most important difference between these two definitions is that Putnam's definition tends to conceptualize social capital as a horizontal measure where social capital can be strong within specific groups in a society, whereas Knack and Keefer conceptualize social capital as a broader term, measuring trust and civic norms at the national level rather than group level. Indeed, Knack and Keefer argue that associational activity can have ambiguous effects on economic performance, trust and civic cooperation. The risk is that associational activity can facilitate rent-seeking, as well as weaken trust between groups in society. They find, in contrast to Putnam, that associational activity does not have a significant effect on economic performance. Therefore, social capital that manifests itself at the national level may be more relevant for institutions and economic performance than social capital measured at the group level.

Baldicchino (2005) argues that social capital is a key factor in explaining the favorable economic and institutional results that often develop on island jurisdictions. Like Knack and Keefer, he acknowledges that social capital can be detrimental if it is strongest within distinct groups rather than at the national level, and argues that islands may be better able to foster a sense of national identity that is stronger than group identity (such as ethnicity, for example) than non-islands. Perhaps the greatest advantage of island jurisdictions is that their "geographical precision" may give islanders a distinct sense of place, which in turn may lead to a sense of unitarism (Baldicchino, 2005). Therefore, if islands face an advantage in terms of accumulating society level social capital as opposed to group level social capital, then this may help to

explain their relatively better economic and institutional performance. This suggests that identity may play an important role, as island jurisdictions that fail to foster a national identity that is stronger than group identity may not benefit from social capital at all or, even worse, may suffer the adverse effects of group level social capital (such has been the case in Fiji and Haiti, for example).

As mentioned above, the "geographical precision" of islands may help foster a sense of national identity. So far, our measure of island status has only included islands with no land borders, which would fit with the above hypothesis. However, may studies include countries that occupy parts of islands in the island category. Therefore, we run regressions for *Political Rights* and *Rule of Law* where we introduce a second measure of island status (*Island2*) that includes partial islands, increasing the total number of islands by six.[18] The results are presented in table 15. Columns (1) shows the results for *Political Rights* when *Island2* is included instead of *Island*. While *Island2* is positive and significant, it is less significant than *Island* (column (1) in table 2). In column (2), a dummy variable is included that indicates an island has land borders (*Isl LB*). While this variable is negatively related to *Political Rights*, it is also insignificant. Therefore, we cannot conclude that islands with land borders have significantly worse political rights than islands with no land borders. In columns (3) - (6), the dependent variable is *Rule of Law*. In all cases, *Island2* is significantly and positively related to economic institutions. Further, *Isl LB* is negative and significant, indicating that islands with land borders have significantly worse economic institutions than islands without land borders. Therefore, while the evidence indicates that geographical precision (i.e. no land borders) is positively related to institutional quality, the results are only significant in the case of economic institutions.

[18] The countries now considered islands are Brunei, Dominican Republic, Haiti, Indonesia, Papua New Guinea and East Timor.

Table 15: Regression results for Political Rights and Rule of Law in 2004, including islands with land borders as islands.

Dependent Variable:	Political Rights			Rule of Law		
	(1)	(2)	(3)	(4)	(5)	(6)
Island2	0.92**	1.10***	1.38**	1.81***	1.94***	2.36***
	(0.38)	(0.39)	(0.58)	(0.56)	(0.63)	(0.58)
Isl LB		-1.18			-1.22**	-1.51***
		(0.75)			(0.58)	(0.56)
LArea			-0.28***		-0.23***	
			(0.06)		(0.06)	
LPop				-0.30***		-0.26***
				(0.07)		(0.07)
Latitude	0.00	-0.01	0.05***	0.05***	0.05***	0.05***
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Isl2 x Lat			-0.08***	-0.09***	-0.09***	-0.10***
			(0.03)	(0.03)	(0.03)	(0.03)
N	120	120	120	120	120	120
R-squared	0.3956	0.4089	0.5616	0.5503	0.5787	0.5787

Note: Standard errors are given in (). Estimated intercepts are omitted from the table. The superscripts ***/**/* indicate a p-value less than 0.01/0.05/0.10, respectively. Included continent dummies are Africa, Latin America (including Mexico), Middle East, Oceania and Neo-Europe (Australia, Canada, New Zealand and the United States of America).

5 Conclusions

The purpose of this paper has been to explore the effects of island status and country size on institutional quality (measured in terms of *Political Rights* and *Rule of Law*), and to determine if these institutional effects can explain the relatively strong economic performance of islands and small countries. Previous theoretical and empirical research indicates that small country size and island status are positively related to political institutional quality, while there is little research into the effect of country size and island status on economic institutional quality. This is particularly so in the case of islands. Therefore, one contribution of this paper has been to establish that small countries and islands have relatively strong economic institutions. Further, to our knowledge there is no other study that has linked institutional quality to the relatively strong economic performance of islands and small countries.

Our results indicate that island status and small country size are positively and significantly related to institutional quality, and that these results are robust to the inclusion of an array of control variables. We also demonstrate

that island status and small country size are positively related to levels of per capita GDP, using average data from 1960 to 1995, as well as data from 2004. This is in keeping with the results found in much of the previous empirical literature on the subject. When *Rule of Law* is included in these regressions by means of two-stage least squares, however, the positive island and small country size effects disappear, indicating that the strength of economic institutions in these countries accounts for their relatively stronger economic performance.

The results in this paper do not, however, provide any conclusive explanations as to why islands and small countries exhibit relatively stronger institutional quality. Rather, the evidence indicates possible avenues for further research. One such avenue is to explore the nature of colonial rule in greater detail, as direct rule and closer political connections between the former colonizing country and the former colony seem to be beneficial for economic institutions. Another possible explanation for the relatively stronger performance of islands in terms of institutional quality may lie in the accumulation of social capital. This in turn may be facilitated by the geographical precision of islands, which is thought to be an advantage in the formation of a strong national identity.

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Data Appendix

Table A1: Definitions of the variables.

Variable	Definition
Political Rights	Political rights. Source: Freedom House (2005)
Rule of Law	Rule of law. Source: Kaufmann et al (2005)
Island	Dummy variable=1 if country is an island with no land borders. Source: CIA (2005) and own assessment.
Population	Total population ('000) in 2004. Source: World Development Indicators 2005.
LPop	Natural logarithm of Population.
Area	Total land area (in'000 km). Source: CIA (2005).
LArea	Natural logarithm of Area.
Latitude	Absolute value of latitude degree. Source: World Bank (2005) and CIA (2005)
Open	Open=(exports + imports)/GDP in current prices local currency units, 2002. Source: World Development Indicators 2005.
LOpen	Natural logarithm of Open.
ExpNonF	Country's major export category (i.e. 50% of total exports or more) is non-fuels. Source: World Bank (2005) and CIA (2005).
ExpFuels	Country's major export category (i.e. 50% of total exports or more) is fuels. Source: World Bank (2005) and CIA (2005).
Vuln	Country's score on the Vulnerability Index (from 0 to 1). Source: Briguglio (1995).
Settler Mortality	Estimated settler mortality. Source: Acemoglu et al (2001).
LMort	Natural logarithm of Settler Mortality.
Pop. Density 1500	Population density in 1500. Source: Acemoglu et al (2002).
LPopDen	Natural logarithm of Pop. Density 1500.
Portugal	Dummy variable=1 if the last colonizing power was Portugal. Source: CIA (2005) and own assessment.
France	Dummy variable=1 if the last colonizing power was France. Source: CIA (2005) and own assessment.
UK+Neo	Dummy variable=1 if the last colonizing power was the UK or a Neo-European country. Source: CIA (2005) and own assessment.
Indirect	The extent of indirect rule by the UK in 1955. Source: Lange (2004).
Dependent	Dummy variable=1 if the country is a dependent territory. Own assessment.
Years Indep	Number of years the country has been independent from most recent colonial period. Source: CIA (2005) and own assessment.
Island2	Dummy variable=1 if country occupies all or part of an island. Source: CIA (2005) and own assessment.
Isl LB	Dummy variable=1 if country is an island with a land border. Source: CIA (2005) and own assessment.
Av GDP 1960-1995	The average per capita real GDP for the period 1960-1995. Source: Easterly and Kraay (2000).
Log Av GDP 1960-1995	Natural logarithm of Av GDP 1960-1995.
GDP 2004	PPP per capita GDP for 2004. Source: CIA (2005)
Log GDP 2004	Natural logarithm of GDP 2004.
Small State 1	Dummy variable=1 if the country's average population over the period 1960-1995 was less than one million. Source: Easterly and Kraay (2000).
Small State 2	Dummy variable=1 if Small State 1=1 or the country's average population in 2004 was less than 1.5 million. Own assessment.
Small State 3	Dummy variable=1 if the country's average population in 2004 was less than one million. Own assessment.

Table A2: Summary statistics of the variables.

Variable	Full Sample			Islands			Non-Islands		
	Mean	St. Dev.	N	Mean	St. Dev.	N	Mean	St. Dev.	N
Political Rights	4.39	2.04	120	5.61	1.68	33	3.93	1.99	87
Rule of Law	4.56	1.78	127	5.69	1.52	37	4.10	1.67	90
Island	0.29	0.46	127	1.00	0.00	37	0.00	0.00	90
Population	28420.65	103430.20	127	4184.85	14053.94	37	38384.26	121329.10	90
LPop	8.20	2.29	127	5.97	2.06	37	9.12	1.68	90
Area	659.51	1570.60	127	38.83	113.16	37	914.67	1805.85	90
LArea	4.05	3.07	127	0.67	2.50	37	5.44	2.04	90
Latitude	15.55	9.98	127	15.91	9.04	37	15.41	10.38	90
Open	82.20	45.16	103	102.84	32.24	23	76.26	46.73	80
LOpen	4.27	0.52	103	4.58	0.37	23	4.19	0.53	80
ExpNonF	0.34	0.48	127	0.16	0.37	37	0.41	0.49	90
ExpFuels	0.10	0.30	127	0.05	0.23	37	0.12	0.33	90
Vuln	0.47	0.15	80	0.60	0.12	25	0.42	0.12	55
Settler Mortality	235.32	430.29	78	105.90	156.38	10	254.36	454.56	68
LMort	4.70	1.20	78	3.96	1.25	10	4.81	1.17	68
Pop. Density 1500	4.69	11.46	95	2.38	3.59	17	5.20	12.50	78
LPopDen	0.45	1.52	95	0.27	1.13	17	0.49	1.59	78
Portugal	0.06	0.24	127	0.05	0.23	37	0.07	0.25	90
France	0.20	0.41	127	0.08	0.28	37	0.26	0.44	90
UK+Neo	0.52	0.50	127	0.81	0.40	37	0.40	0.49	90
Indirect	38.64	32.27	32	11.84	23.52	9	49.13	29.27	23
Dependent	0.06	0.23	127	0.11	0.31	37	0.03	0.18	90
Years Indep	63.88	58.00	127	33.92	24.01	37	76.20	63.27	90
Island2	0.35	0.48	127	1.00	0.00	37	0.09	0.29	90
Isl LB	0.06	0.24	127	0.00	0.00	37	0.09	0.29	90
Av GDP 1960-1995	3188.52	3910.98	105	4432.30	3845.98	25	2799.83	3872.98	80
Log Av GDP 1960-1995	7.57	0.95	105	8.05	0.86	25	7.41	0.93	80
GDP 2004	6874.02	8509.56	127	8894.60	9175.12	37	6043.33	8128.35	90
Log GDP 2004	8.21	1.12	127	8.57	1.09	37	8.06	1.11	90
Small State 1	0.28	0.45	110	0.74	0.45	27	0.13	0.34	83
Small State 2	0.34	0.48	127	0.76	0.43	37	0.17	0.37	90
Small State 3	0.30	0.46	127	0.73	0.45	37	0.12	0.33	90

Table A3: Descriptive statistics for extent of indirect rule 1955 and country size.

Non-Islands			Islands		
Country	Extent of Indirect Rule 1955 (%)	Log Area	Country	Extent of Indirect Rule 1955 (%)	Log Area
Bangladesh	60	4.87	Bahamas	0	2.30
Belize	0	3.13	Barbados	0	-0.84
Botswana	42.5	6.34	Fiji	55	2.91
Brunei	0	1.66	Jamaica	0	2.38
Gambia	37.3	2.30	Mauritius	0	0.71
Ghana	64.8	5.43	Singapore	0	-0.49
Guyana	0	5.28	Solomon Islands	51.6	3.33
India	60	8.00	Sri Lanka	0	4.17
Kenya	58.8	6.34	Trinidad	0	1.64
Lesotho	49.5	3.41			
Malawi	81.8	4.54			
Malaysia	6.1	5.79			
Myanmar	60	6.49			
Nigeria	93.4	6.81			
Pakistan	60	6.65			
Sierra Leone	80.8	4.27			
Sudan	72.6	7.77			
Swaziland	49	2.84			
Tanzania	74.5	6.78			
Uganda	79.6	5.28			
Zambia	59.6	6.61			
Zimbabwe	39.7	5.96			
Average	51.36	5.30		11.84	1.79
- Africa	63.14	5.34		0	0.71
- Asia	40.02	5.58		0	1.84
- Latin America	0	4.20		0	1.37
- Oceania	N/A	N/A		53.3	3.12

Source: Lange (2004), CIA World Factbook (2005) and author's own calculations.

Table A4: List of countries included in the analysis.

Non-Islands			Islands
ALGERIA	GUYANA	TUNISIA	ANTIGUA
ANGOLA	HAITI	UGANDA	BAHAMAS
ARGENTINA	HONDURAS	UNITED ARAB EMIRATES	BAHRAIN
AUSTRALIA	HONG KONG*	UNITED STATES	BARBADOS*
BANGLADESH	INDIA	URUGUAY	BERMUDA
BELIZE	INDONESIA	VENEZUELA	CAPE VERDE
BENIN	KENYA	VIETNAM	CAYMAN ISLANDS*
BHUTAN	KUWAIT	YEMEN	COMOROS
BOLIVIA	LAOS	ZAMBIA	CUBA
BOTSWANA	LESOTHO	ZIMBABWE	DOMINICA
BRAZIL	LIBYA		FIJI
BRUNEI	MACAO*		GRENADA
BURKINA FASO	MALAWI		JAMAICA
BURUNDI	MALAYSIA		KIRIBATI
CAMBODIA	MALI		MADAGASCAR
CAMEROON	MAURITANIA		MALDIVES
CANADA	MEXICO		MARSHALL ISLANDS
CENTRAL AFRICAN REPUBLIC	MOROCCO		MARTINIQUE*
CHAD	MOZAMBIQUE		MAURITIUS
CHILE	MYANMAR		MICRONESIA
COLOMBIA	NAMIBIA		NAURU
CONGO	NICARAGUA		NEW ZEALAND
COSTARICA	NIGER		PHILIPPINES
COTE D'IVOIRE	NIGERIA		PUERTO RICO*
DR CONGO	PAKISTAN		SAMOA
DJIBOUTI	PANAMA		SAO TOME
DOMINICAN REPUBLIC	PAPUA NEW GUINEA		SEYCHELLES
EAST TIMOR	PARAGUAY		SINGAPORE
ECUADOR	PERU		SOLOMON ISLANDS
EGYPT	QATAR		SRI LANKA
EL SALVADOR	RWANDA		ST KITTS
EQGUINEA	SENEGAL		ST LUCIA
ERITREA	SIERRA LEONE		ST VINCENT
FRENCH GUIANA*	SOMALIA		TONGA
GABON	SOUTH AFRICA		TRINIDAD
GAMBIA	SUDAN		TUVALU
GHANA	SURINAME		VANUATU
GUATEMALA	SWAZILAND		
GUINEA	TANZANIA		
GUINEA BISSAU	TOGO		

Note: Countries with an asterisk beside their names were not politically independent as of 2004.

Endogenous Institutional Change after Independence

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Abstract

Independence from colonial rule was a key event for both political and economic reasons. We argue that newly-independent countries often inherited sub-optimal institutional arrangements, which the new regimes reacted to in very different ways. We present a model of endogenous changes in property rights institutions where an autocratic post-colonial elite faces a basic trade-off between stronger property rights, which increases the dividends from the modern sector, and weaker property rights that increases the elite's ability to appropriate resource rents. The model predicts that revenue-maximizing regimes in control of an abundance of resource rents and with insignificant interests in the modern sector will rationally install weak institutions of private property, a prediction which we argue is well in line with the experience of several developing countries.

Keywords: institutions, property rights, independence, resource rents, rent seeking

JEL Codes: O17, O57, P14

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1 Introduction

The rules that societies live by have proven to be crucial for all kinds of economic development. A number of recent studies have established links between the general quality of countries' economic institutions and, for instance, income per capita (Hall and Jones, 1999; Acemoglu, Johnson and Robinson (AJR), 2001a, 2002; Easterly and Levine, 2003; Acemoglu and Johnson, 2005; Olsson and Hibbs, 2005). Perhaps more difficult to understand is what explains the wide international variation in measures of institutional quality. Empirical and theoretical efforts in this tradition have typically focused on deep historical explanations such as the various effects of colonialism (AJR, 2001a, 2002; Sokoloff and Engerman, 2000) or the role of the sovereign in the legal and economic systems of medieval Spain, France, and Britain (North, 1990; Glaeser and Shleifer, 2002). However, although institutions typically display a high degree of persistence, we believe that the institutional configuration of countries is undoubtedly also influenced by more recent historical events.

The central issue that we address in this article is why more or less equally undemocratic regimes installed widely different institutions for private property after independence. In countries like Singapore, the government pursued a strengthening of property rights and of the protection against government expropriation, whereas development was quite the reverse in some initially relatively developed countries like Ghana and Zambia.

In order to understand this process, we present a model of endogenous change in property rights institutions and constraints against the executive. We take 'as given' the deeper historical effects of for instance the identity of the colonizer, and model endogenous institutional choice for a more or less autocratic elite who maximize their own utility in a two-period setting. The first period starts at independence and is typically characterized by sub-optimal property rights institutions from the perspective of the new regime.[1] The ruling elite has economic interests in a modern, formal sector but can also appropriate rents from a natural resource sector. These circumstances imply that the ruling elite faces a basic trade-off between weak and strong institutions of private property. Strong property rights will make the formal sector

[1] See Acemoglu, Johnson and Robinson (2001a, 2002) for possible explanations as to why colonial powers might establish extractive institutions in the colonies. Further, Djankov et al (2003) argue that the institutions put in place by colonial powers were likely to be inefficient, even when the colonizers attempted to transplant their own institutional arrangements directly.

prosper and raise the ruling elite's incomes from that sector. Weaker property rights, on the other hand, means a poorly functioning formal economy but makes the ruling elite's expropriation of rents easier.

Our model predicts that ruling elites are more inclined to weaken property rights if easily appropriable natural resource rents abound, whereas the lack of an 'easy rents-sector' coupled with substantial interests in a modern sector will motivate even an autocratic ruling elite to install stronger private property rights, which in turn results in higher growth. The costs of institutional change also play a central role in our model. Such costs will to a great extent depend on the geography of the country, in particular on the geographical distribution of the population and on the country size. In addition, a higher initial level of property rights protection will diminish, in some instances even negate, the negative impact of natural resource abundance on growth, as demonstrated empirically by Mehlum et al (2006).[2] We argue that the main insight from our model is well in line with observed post-colonial experiences in many developing countries. Although independence from colonial rule is the main type of change that we have in mind, we believe that our model might also have relevance for understanding the institutional choices after other discontinuous regime shifts such as the transition from communism, or even the onset of colonization. Indeed, Beck and Laeven (2005) find evidence that natural resources have been a major impediment to institutional development in transition economies.

Our research extends a long tradition stretching back to Adam Smith that emphasizes the central role of property rights in development (Coase, 1960; Demsetz, 1967; Alchian and Demsetz, 1973; North, 1981, 1990; Firmin-Sellers, 1995; de Soto, 2000). Our argument about the forces behind the choice between weak and strong private property rights is to some extent inspired by AJR's (2001a, 2002) colonial theory of how European settlers installed 'extractive institutions' when the disease environment was hostile for permanent settlement and when there were easily exploitable human resources (proxied by population density and degree of urbanization). According to the same logic, strong institutions were created where permanent European settlement was feasible. The formal model in this article shares the basic prediction in AJR's (2002) empirical work that the regime's own interests in a progressive sector is crucial for understanding institutional choice. However,

[2] See Sachs and Warner (2001), Gylfason (2001), and Woolcock et al (2001) for discussions of the possible reasons for the observed 'curse of natural resources'.

we believe that this aspect was probably even more important during the post-colonial era when each former colony was left on its own and policy was unaffected by the particular preferences or ideologies of the colonial powers.

Like North (1981), Acemoglu and Johnson (2005), and Djankov et al (2003), we recognize that property rights institutions affect the economy along two dimensions. The first dimension is the relationship between common men, for instance whether private property is secure against expropriation by a neighbor. The second dimension is the interaction between ruling elite and subject and to what extent the government can expropriate means from the people. In their empirical efforts to 'unbundle' institutions to determine what kind of influence different institutions have, Acemoglu and Johnson (2005) show that property rights constraining the ruling elite from expropriation appear to be the more important dimension for development.[3] Furthermore, Glaeser et al (2004) show in their empirical analysis that almost all former colonies in 1960 were dictatorships. The crucial question that arises from their analysis, and which we examine in this article, is why some autocratic ruling elites pursued growth-oriented policies (such as strengthening property rights institutions) while others did not.

Besley (1995) proposes several models for the relationship between property rights and capital investment in a micro-level analysis of property rights in two regions in Ghana. Though highly relevant at the micro level, these models have little to say about the considerations at the macro level of a utility maximizing autocrat. Like us, Svensson (1998) analyzes the potential reasons why a government does not invest in stronger property rights. The basic reason in Svensson's model is that ruling elites are uncertain about staying in power due to political instability and hence do not internalize the full benefit of institutional investment, a scenario which differs from ours where the potential for capturing rents is the key feature. Persson (2004) argues that the emergence of parliamentary democracy might be an important mediating factor between historical institutions on the one hand and 'structural policies' (what is referred to here as institutions) and economic performance on the other. In our model, we take a low degree of democracy as given, an assumption which seems to be well in line with the evidence in Glaeser et al (2004). Other models of property rights and growth include Tornell (1997)

[3] Throughout the article, we will use 'property rights institutions' and 'constraints against the executive' as synonymous terms, reflecting the elite's respect for private or state ownership. Respect for state ownership means that the elite does not regard state-owned property as their own.

and Sonin (2003).

The paper is organized as follows. Section two develops the basic argument by analyzing post-colonial experiences of institutional development. Section three outlines the ruling elite's basic trade-off in terms of investment in property rights institutions and proceeds by presenting a solution to the full model. Section four then makes labor supply endogenous and introduces variations such as trade liberalization. Section five concludes the paper.

2 Institutional Development After Independence

The argument that we make is that although colonial policy certainly is relevant for understanding the current institutional environment, independence was something of a crossroads that took countries in widely different directions. A pure colonial theory of institutional choice thus needs to be complemented with a hypothesis of post-colonial developments. We believe that two (or perhaps three) factors played a crucial role during this era: the prevalence of easily appropriable point resource rents and the ruling elite's own economic interest in a modern sector. In countries where natural resource rents were relatively important, revenue-maximizing autocratic elites had strong incentives for maintaining weak property rights since that made the expropriation of rents from the immobile resource sector easier. When the modern sector was more important for the regime, on the other hand, a weakening of private property rights implied a deterioration of the formal sector since workers (or capital) would retreat to other sectors. In addition, the costs of institutional change varied greatly across countries which also contributed to the very different experiences.

In order to make our hypothesis more concrete, we will briefly discuss the post-independence development in five countries: Singapore, DR Congo, Botswana, Zambia, and Ghana.

2.1 Singapore

Singapore achieved full independence from Great Britain in 1965, but the first steps towards independence began ten years earlier with the proclamation of Singapore's first constitution and the first parliamentary elections. By 1959 a Singaporean, Lee Kwan Yew, had replaced the British governor as head of state, giving Singapore autonomy over its internal affairs (Haas, 1999). This relatively smooth transition from colony to independent country meant that

Singapore not only had a comparatively developed and prosperous economy, but also well-functioning institutions (Huff, 1999).

Singapore's geography presented both challenges and opportunities. On the one hand, Singapore is not directly connected to a self-supporting agricultural base and relies on neighboring Malaysia for its water supply, leaving the country somewhat vulnerable. On the other hand, the lack of natural resources and agriculture made export-led economic growth a natural goal for the new leaders of Singapore. Further, the city-state does not exhibit large ethnic fractionalization, and its compact size reduces the costs of the broadcasting of power.

From the outset, Singapore aimed to attract foreign investment, and began to reap the rewards of this strategy starting in the early 1980s when foreign direct investment began to rise dramatically (Huff, 1999). The government is also involved in the economy, operating a large number of statutory boards (approximately 70) and government linked corporations (approximately 500) (Lingle and Wickman, 1999). The statutory boards, some of which provide services that could be provided by private businesses, are required to give 33 percent of their operating surplus to the government. The government linked corporations are involved in the private sector and operate as private enterprises, the only exception being that they are partially or wholly owned by the government. One reason for such government involvement in the private sector is that the government can provide investment capital when it deems that the market is being overcautious (Li, 2002).

Since 1985, government expenditures have averaged about 20 percent of GDP. These expenditures have been financed through government monopolies (such as utilities), but also through the Central Provident Fund (CPF), which is a mandatory pension scheme for workers that places 40 percent of total labour earnings at the disposal of the Government of Singapore Investment Corporation, and allows the government to borrow below market interest rates (Lingle and Wickman, 1999; Huff, 1999). In effect, the CPF acts as a tax on labor.

Singapore's economic success relies on several factors. Good initial institutions play a large role, as do geographical factors such as size and the existence of a large natural port. The government's willingness to commit to strong economic policies is also critical, and helped in part by the stability of the ruling People's Action Party, which has held at least 95 percent of the seats in parliament since 1968. Finally, by focusing on multinational corpo-

rations, Singapore has facilitated the transfer of technology to its economy, a problem that other developing countries have had troubles overcoming (Lingle and Wickman, 1999).

2.2 DR Congo

While Singapore is an example of economic success in a former colony, DR Congo is an example of one of the worst economic failures. DR Congo's transition to independence did not run smoothly; Belgium shortened the time horizon from four years to six months after witnessing the problems France had with its own decoloninzation project (Saideman, 1997). In addition,the Belgian colonial rulers had focused most of their efforts on the extraction of mineral resources and did not leave DR Congo with a strong institutional framework.

DR Congo's geography has proven to be problematic as well. The country is vast, but the population is concentrated to areas around the borders, while the interior is virtually empty. This makes investment in both infrastructure and institutions costly and relatively inefficient (Herbst, 2000). The high degree of ethnic fractionalization in DR Congo only serves to exacerbate the problem. Even DR Congo's immense wealth of natural resources have had a disastrous effect on the country's economic growth.

Mobutu Sese Seko took power in DR Congo in 1965 and had started a process called 'Zairianization' by the 1970s, which involved the transfer of most of the colonial enterprises and a considerable portion of the agricultural sector to the government (Young, 1994). As the economy continued to falter, Mobutu focused his efforts increasingly on personal enrichment. By far the most rewarding enrichment strategy was Mobutu's control of the natural resource sector, primarily through the state-owned mining company. Further, Mobutu received extensive foreign aid from his western allies due to DR Congo's role as an anti-communist bastion in Africa. Mobutu's private fortune is believed to have been as much as 4 billion USD in 1984, an amount almost equivalent to the country's foreign debt at the time (Ndikumana and Boyce, 1998). In the meantime, DR Congo was plagued by poor economic growth and a mounting public external debt. Mobutu was finally overthrown in 1997 by a rebel group led by Laurent Kabila, who took over as president of DR Congo and quickly began to emulate the practices of the deposed Mobutu (Nzongola-Ntalaja, 2002).

In stark contrast to Singapore, DR Congo was faced with several disad-

vantages at the time of independence. The initial quality of institutions was quite low, and the transition from colony to independent country was not a smooth one. Further, the geographic size of DR Congo was not conducive to institutional investment. The availability of vast amounts of natural resource rents provided Mobutu, and later Kabila, with little incentive to expand the formal economy. Although Kabila's son, Joseph, has shown signs of moving away from the legacy of kleptocracy, the continued conflict in and around the country reduces both Kabila's ability to improve institutions and the attractiveness of DR Congo to foreign investment.

2.3 Botswana

If DR Congo is perhaps the worst of all African tragedies, Botswana is one of the success stories. The country was a British colony (Bechuanaland) and received independence in 1966. Although the land area is relatively large, most of the country is uninhabited desert and almost all of the population lives in the south-east. According to the criteria developed by Herbst (2000), the geographical distribution of Botswana's population is therefore relatively favorable with low costs for the broadcasting of power.

Upon independence, the country was believed to have a bleak future due to the lack of industries and agricultural potential. However, according to Acemoglu et al (2001b), social institutions actually started off from a relatively good level. Colonial policy had in most instances left few marks on the country and the parliament-like democracy practiced within the dominant Tswana tribe (in an assembly referred to as the *kgotla*) continued to play a central role after independence, which meant that the ruling elite was more effectively constrained than elsewhere. Another favorable circumstance was that the Tswana elite that gained power after independence had themselves important stakes in the only significant export-sector for cattle. This may have further strengthened incentives to maintain strong private property rights.

The discovery of enormous diamond reserves of high quality around 1970 then transformed the Botswanan economy. Unlike in countries with less favorable initial institutions and distributions of power, the large rents from the mineral sector were used for investments in public goods like education and infrastructure, and also in the strengthening of property rights and law and order (Acemoglu et al, 2001b). As discussed in Olsson (2004), the joint venture between the Botswanan state and the South African diamond firm

De Beers presumably also served as a disciplining device in this regard. By 2005, the country has standards of living comparable to most upper-middle income countries in the world.

2.4 Zambia

Post-independence developments were almost quite the opposite in Botswana's neighbor Zambia. During the colonial era, the territory was known as Northern Rhodesia and was administered first by the South Africa Company and then by the UK. The abundance of copper reserves was well known already in the early 1900s and contributed to the rapid industrialization and urbanization of the mining areas in the 1920s and 1930s. The colony also hosted a large white settler population. At independence in 1965, Zambia was one of the most industrialized and prosperous countries in Sub-Saharan Africa.

Zambia's subsequent economic decline and institutional reversal is almost as dramatic as Botswana's rapid development. Both countries started off with reasonably favorable institutions after British colonial rule. But whereas Botswana's post-independence elite had important interests in the existing export sector, the Zambian government during the 'First Republic' (1965-1973) had not. As argued by Bates and Collier (1993), Zambia was distinguished by the circumstance that the independent government - led by the United National Independence Party (UNIP) - was more or less completely alienated from the progressive sectors in society such as manufacturing and commercial agriculture.

The party's core constituency was instead urban mining workers and the state's major source of revenue was the state mining conglomerate Zambia Industrial and Mining Corporation (ZIMCO). The UNIP government had nationalized the copper industry in 1969. In order to gain ground also within the modern sector, the government created state enterprises in manufacturing that received subsidies and tax credits and that undermined the operation of many private firms. The reduction of competition in the business sectors was soon accompanied by the initiation of one-party rule in 1972 with UNIP in power. When copper prices then fell in the middle of the 1970s, Zambia was caught in a vicious circle of economic deterioration which was met by further distortionary interventions by the government (Bates and Collier, 1993).

Even though liberalization efforts were made in the 1980s and 1990s, the basic pattern prevailed with a government that was dependent on rents from a poorly functioning mineral sector and that neglected the modern sectors. As

documented by Bigsten (2001), rent seeking and various forms of corruption was widespread throughout the period. The major vehicle for rent extraction continued to be the state owned monopoly ZIMCO until it was finally privatized in 2000.

2.5 Ghana

Zambia's starting position was relatively similar to that of Ghana. First among African nations, Ghana received independence already in 1957 and was by then one of Africa's more advanced states politically as well as economically. However, like in Zambia, the government under Kwame Nkrumah soon started to adopt import-substituting policies, combined with an overvalued exchange rate and a nationalization of firms. The elite that came into power had few vested interests of their own in business or in commercial agriculture (Bates, 1981).

The country's main source of export apart from gold is cocoa production. Although an agricultural good like cocoa is not a point resource in the sense that a mine is, it has been shown that coffee and cocoa producing countries have had almost as poor economic development after independence as point resource countries (Woolcock et al, 2001). We believe that this can largely be explained by the use of 'marketing boards'. Marketing boards are state-controlled monopsonies for the purchase of agricultural products from small farmers which are then sold on the world market. The existence of marketing boards was motivated by the fact that the world market prices of cocoa and coffee tend to fluctuate a lot. By keeping the price towards farmers stable, the marketing boards were intended to accumulate funds during booms which would then ensure farmers a higher price than on the world market in bad times.

Although this institution sounds reasonable in theory, it has been a major source of corruption and rent seeking in several African countries. As described extensively by Bates (1981), the existence at independence of large accumulated funds provided too great a temptation for revenue-hungry ruling elites with no vested interests of their own in the modern sectors. In Ghana, the marketing board for cocoa was gradually taken over by the state. This strategy was yet another step towards a more or less intentional weakening of property rights, and the response was a decline in cocoa production as well as in manufacturing. The country soon elapsed into serious political turmoil with military coups and dictatorial regimes.

We believe that the lesson from these country examples is that the prevalence of a government-controlled stream of resource rents, in combination with weak interests in the modern sectors as in DR Congo, Zambia, and Ghana, provided post-independence ruling elites with incentives to neglect or indeed weaken property rights institutions. In the initially resource-poor Singapore and Botswana, a strengthening of property rights proved to be a more promising strategy for the revenue-seeking elites. When the windfall gains from diamond mining then fell on Botswana, the appropriate institutions were in place to use the rents for truly growth-promoting strategies.

3 The Model

In this section, we present a two-period model of an autocratic ruling elite's endogenous choice of costly property rights reforms. For simplicity, we assume that the ruling elite does not have to worry about being overthrown as long as they provide a minimum of public goods.[4] The country has just emerged from independence and the ruling elite has inherited property rights institutions from a former colonial regime. While it is possible that these institutions are optimal, it is more likely that they are not. As will be shown, the model serves to explain how it even might be optimal for a ruling elite to weaken property rights institutions.

3.1 Basics

Let us assume a scenario with an autocratic ruling elite or ruling elite who is primarily motivated by the possibility of making personal revenue with the least possible effort. The ruling elite has two potential sources of personal gain: their private (non-state) interests in a modern sector and a more or less easily appropriable flow of rents from a state-controlled natural resource sector. These incomes are available in a current as well as in a future period. The ruling elite also controls (but cannot make personal gain of) the government budget with revenues from the natural resource sector and income taxes on labor. In order to avoid being overthrown, the ruling elite has to supply a fixed (minimum) amount of public goods like infrastructure, defense, and police in their first period to uphold the most fundamental functions of the state. What remains in the public budget can be spent on costly reforms of

[4] There is a growing literature studying the mechanisms through which non-benevolent rulers might stay in power for decades in developing countries despite the presence of potential rebels (Olsson and Congdon Fors, 2004; Acemoglu, Robinson, and Verdier, 2003)

the prevailing property rights institutions. It is assumed that all changes in property rights, regardless of whether they involve a weakening or a strengthening or rights, give rise to direct costs. The ruling elite gains utility only from personal enrichment.

These basic assumptions are summarized in equation (1), showing the ruling elite's utility function in general form:

$$U_r = R_0 + M_0 - e\left(|Z_1 - Z_0|\right) + \delta\left[R_1\left(Z_1\right) + M_1\left(Z_1\right)\right]. \tag{1}$$

The utility of the ruling elite is a simple linear function of wealth in the form of current and future expropriated rents R_0 and $R_1\left(Z_1\right)$ and of current and future profits from the ruling elite's private interests in the modern sector M_0 and $M_1\left(Z_1\right)$. Utility is also a negative function of the effort of changing property rights $e\left(|Z_1 - Z_0|\right)$. $\delta \leq 1$ is a time discount factor. Z_1 is the quality of property rights institutions and constraints against the executive in the future period and is the ruling elite's key choice variable. They have inherited a property rights regime of strength Z_0 and consider increasing or decreasing this level. The personal costs of these changes are a function of the absolute level of $(Z_1 - Z_0) = \Delta Z$ such that $e'\left(|\Delta Z|\right) > 0$ and $e\left(0\right) = 0$. In other words, investments over the prevailing level $(\Delta Z > 0)$ give rise to an equally large disutility as disinvestments $(\Delta Z < 0)$ and the least disutility is gained from status quo $(\Delta Z = 0)$ when no effort at all is exerted in either direction.

A central assumption of the paper is that $R_1'\left(Z_1\right) < 0$ since weak constraints against the executive makes expropriation of natural resource rents for personal gain easier. With strong constraints against the executive, the ruling elite will be unable to use the state companies as a personal source of revenue. Equivalently, $M_1'\left(Z_1\right) > 0$ since stronger property rights will have a positive effect on output in the modern sector. The assumption that the same type of property rights institutions affect the natural resource sector and the modern sector is a cornerstone of our model. A potential objection might be that the institutions constraining the ruling elite from expropriating natural resource rents are different from the institutions affecting modern sector output. If that was the case, there would be no trade-off of the kind modelled here and a kleptocratic ruling elite should simply minimize the constraints against expropriation in the natural resource sector and maximize the strength of private property rights in the modern sector.[5]

[5] Deliberate institutional differences between a formal and an informal sector are modelled

However, as will be specified below, it will be assumed here that the ruling elite's revenue from the modern sector comes from private minority shareholding. Since the ruling elite thus is directly involved both in the resource sector (through state-ownership) and in the modern sector (through private ownership), rational firm-owners in the modern sector will judge the quality of property rights by the standards of behavior that the ruling elite employs in the resource sector. If the ruling elite steals natural resource rents from the state-owned companies for their own enrichment, rational firm-owners will expect that sooner or later the ruling elite will do the same in the modern sector. Hence, both sectors will be affected by the same set of institutions, measured by Z_t.

If we disregard the government budget and all constraining factors for a moment, the optimal level of Z_1 from the ruling elite's point of view is the solution to the first-order condition:

$$-e'\left(|\Delta Z|\right) \cdot \frac{\partial |\Delta Z|}{\partial Z_1^*} + \delta \left[R_1'\left(Z_1^*\right) + M_1'\left(Z_1^*\right)\right] = 0 \tag{2}$$

This condition relates the basic intuition behind the paper; investment in property rights institutions entails a trade-off for the ruling elite between the direct cost of effort $e\left(|\Delta Z|\right)$ and the indirect cost of lower expropriated rents $R_1\left(Z_1^*\right)$ on the one hand, and the benefits of greater dividends from the modern sector on the other.

3.2 Functional form

With the general form above, however, we cannot derive an explicit solution for Z_1^* or indeed say much else of interest. We will therefore specify a functional form of the utility function and of the government budget constraint that we believe capture the central aspects of the ruling elite's investment decision.

Starting with the appropriable rents R_t, we mentioned earlier that these can most easily be thought of as proceeds from a more or less state-controlled natural resource sector.[6] Let us assume that there is a total flow of rents

in Olsson and Congdon Fors (2004).

[6] See Acemoglu, Johnson, and Verdier (2003) for a similar assumption. Real world examples of more or less state-controlled mining companies are Gecamines (copper) and MIBA (diamonds) in former Zaire, Debswana (diamonds, joint venture with De Beers) in Botswana, Endiama (diamonds) in Angola, and ZIMCO in Zambia. As mentioned above, we believe that marketing boards such as that for cocoa in Ghana might also serve as a source of easily appropriable rents (Bates, 1981).

r_t during period $t = (0, 1)$. For simplicity, we choose to model them as exogenous incomes that are generated without using any inputs and that rents are expected to be stable over time; $r_0 = E_0(r_1) = r$. Since the companies are state-owned, all rents are supposed to flow into the government budget. However, the predatory ruling elite will attempt to confiscate rents for their personal enrichment. The amount that the ruling elite can lay their hands on R_t depends on the existing level of government constraints. We assume that

$$R_t = \max\left(\frac{\left(\bar{Z} - Z_t\right) r}{\bar{Z}}, 0\right) \tag{3}$$

where $\bar{Z}$ is a critical level of institutions beyond which rent appropriation is impossible. The 'max' sign above means that if $Z_t > \bar{Z}$, then $R_t = 0$.[7] We will assume throughout that $Z_t < \bar{Z}$ which arguably is the normal case for the developing countries that we have in mind. The amount of rents that are not expropriated by the ruling elite $Z_t r/\bar{Z}$ flow into the government budget, as will be shown below.

The ruling elite's second source of personal revenue comes from interests in the private sector. To explain how such an ownership has been obtained is beyond the scope of this article.[8] As a share-holder, the ruling elite gets their part of total dividends; $M_t = \eta \Pi_t$ where $\eta < 0.5$. The assumption of $\eta < 0.5$ means that the ruling elite's holdings are relatively small, at least smaller than to give them a majority ownership in the private sector.[9] We further assume that η is uncorrelated with Z_t.

Profits in the modern sector are given by

$$\Pi_t = p_t Q_t - w L_{m,t} = p_t Z_t L_{m,t}^{\beta} - w_t L_{m,t}. \tag{4}$$

The quality of property rights institutions Z_t increases modern sector output Q_t linearly like a (Hicks neutral) total factor productivity variable. $L_{m,t}$ is labor supply to the modern sector at period t, and $\beta < 1$ gives the (diminishing) returns to labor. Labor supply is treated as exogenous and fixed in

[7] This reflects the idea that diversion of natural resource rents in developed countries like Canada, Australia, or the United States do not seem to enter the ruler's objective function.

[8] Evidence from Kenya and an analysis of the ruling elite's private ownership patterns are discussed at length in for instance Bigsten and Moene (1996) where the phenomenon is referred to as 'straddling'.

[9] One could imagine that the ruling elite gains utility not through dividends, but through the general increase in the standard of living brought about by a thriving modern sector. In this case, η would represent the utility derived from the modern sector.

this section so that $L_{m,t} = L_m$ but will be made endogenous below. Workers are paid a wage rate w_t which is equivalent to the value marginal product; $w_t = p_t Z_t \beta L_{m,t}^{\beta-1}$. In other words, modern sector labor will be more productive on the margin (and will be better compensated) if property rights institutions are strong. The price of modern sector output is p_t. Below we will specify the price level to be $p_0 = p_1 = 1$.

In summary, the ruling elite's personal revenue from the modern sector will be

$$M_t = \eta \Pi_t = \eta Z_t L_m^{\beta} (1 - \beta). \tag{5}$$

The ruling elite's disutility of effort is an increasing function of the deviation from status quo:

$$e(|\Delta Z|) = \frac{\theta (Z_1 - Z_0)^2}{2} = \frac{\theta (\Delta Z)^2}{2}$$

where $\theta > 0$ indicates the degree of effort required to carry out changes in property rights institutions. The assumption of a quadratic function ensures that investment and disinvestment are equally costly in terms of disutility and implies that the ruling elite has a kind of status quo bias. Whereas the first derivative with respect to Z_1 can have any sign, the second derivative is unambiguously positive at $\theta > 0$. This means that there is an increasing marginal disutility of institutional change. What this is intended to show is that institutional changes will require more and more effort on the margin as $|\Delta Z|$ increases and hence give rise to a greater and greater utility loss.

All in all, these assumptions give us a more detailed functional form of the ruling elite's objective function in (1):

$$\begin{aligned} U_r = \left(1 - \tfrac{Z_0}{Z}\right) r + \eta Z_0 L_m^{\beta} (1 - \beta) - \frac{\theta (Z_1 - Z_0)^2}{2} + \\ + \delta \left[\left(1 - \tfrac{Z_1}{Z}\right) r + \eta Z_1 L_m^{\beta} (1 - \beta) \right]. \end{aligned} \tag{6}$$

In maximizing personal revenue, the ruling elite has to take into consideration not only the legal constraints but also the fiscal constraints as given by the government budget. We will assume that in order to stay in power for more than one period, the ruling elite has to supply a fixed quantity of public goods G. This quantity includes the costs of police, defense, physical infrastructure, and basic government administration.

The level of G might also be regarded as an indicator of the strength of

one-man-rule. With a given revenue flow, a low G means that the ruling elite has a relatively great degree of freedom in deciding themselves what institutions to create and how much to spend on public goods. Conversely, a high G means that the ruling elite is highly constrained in the process of institutional reform and that they are obliged to satisfy rather ambitious goals in terms of public goods provision in order to avoid being thrown out of office.[10]

A more long-term type of government expenditure is institutional reform. As in much of the literature on adjustment costs in investment, the costs of institutional investment or disinvestment are a convex function of ΔZ: $\psi \left(Z_1 - Z_0\right)^2 /2$ where $\psi > 0$. The second derivative is simply $\psi > 0$, implying an increasing marginal cost. In order to reap the benefits of property rights investment, the ruling elite must be able to credibly enforce these rights. That entails investment in a number of 'supporting' institutions, e.g. court systems, property registration offices, etc. If the ruling elite chooses to disinvest, on the other hand, they will be faced with the costs of dismantling the existing structures and probably also with the cost of compensating the losers from such a reform in some way.[11]

Government revenue has two sources; the non-expropriated rents from the natural resource sector $Z_t r/\bar{Z}$ and a proportional income tax on workers in the modern sector $twL_m = tZ_t\beta L_m^{\beta}$. The marginal tax rate t might be thought of as the (exogenously given) revenue-maximizing tax rate as in a Laffer-curve. The governmental budget restriction in the initial period states that fixed government outlay plus the costs of property rights investment or disinvestment must not exceed revenue, i.e.:

$$G + \frac{\psi \left(Z_1 - Z_0\right)^2}{2} \leq tZ_0\beta L_m^{\beta} + \tfrac{Z_0 r}{\bar{Z}}. \tag{7}$$

We assume for the remainder of the article that $G < tZ_0\beta L_m^{\beta} + Z_0 r/\bar{Z}$ so that the ruling elite always has some scope for institutional reform. Further, the level of Z_1 must be such that second period revenue is sufficient to cover the second period fixed government outlay, i.e.:

[10] See Aghion et al (2004) for a model of an endogenously determined political insulation from the people.

[11] It might be argued that disinvestment in property rights institutions is less costly than investment. A way to formalize this notion would be to include a $\psi' < \psi$ for disinvestment costs. In the extreme case, one could have a $\psi' = 0$ which would imply that a worsening of institutions is costless. However, we do believe that it is reasonable to assume that rulers are always somewhat constrained from destroying property rights completely.

$$G \leq tZ_1\beta L_m^{\beta} + \tfrac{Z_1 r}{Z}. \tag{8}$$

These budget restriction imply that the optimal level of property rights institutions is defined in the interval $Z_1^* \in \left[\max\left(\tilde{Z}_1^-, \hat{Z}_1^-\right), \hat{Z}_1^+\right]$ where

$$\tilde{Z}_1^- = \frac{G}{t\beta L_m^{\beta} + \frac{r}{Z}} > 0 \tag{9}$$

and

$$\hat{Z}_1^- = Z_0 - \sqrt{\frac{2\left(tZ_0\beta L_m^{\beta} + \frac{Z_0 r}{Z} - G\right)}{\psi}} \gtreqless 0 \tag{10}$$

while the upper boundary of property rights in period 1 is

$$\hat{Z}_1^+ = Z_0 + \sqrt{\frac{2\left(tZ_0\beta L_m^{\beta} + \frac{Z_0 r}{Z} - G\right)}{\psi}} > 0. \tag{11}$$

Note that the scope for reform in either direction increases with r, t and L_m^{β} and decreases with G. In addition, the scope for reform in either direction increases with Z_0 and decreases with ψ with respect to the first period budget constraint. The 'max'-term defining the lower bound of Z_1^* reflects the constraint that the actual Z_1^* is necessarily non-negative whereas a negative institutional level might be financially viable in terms of the first period budget constraint (i.e. if $\hat{Z}_1^- < 0$).

3.3 Optimal institutional change

The utility function and the governmental budget constraint form a maximization problem for the ruling elite

$$\max_{Z_1} U_r \qquad \text{subject to } \psi\left(Z_1 - Z_0\right)^2/2 \leq tZ_0\beta L_m^{\beta} + \tfrac{Z_0 r}{Z} - G \qquad \text{and } tZ_1\beta L_m^{\beta} + \tfrac{Z_1 r}{Z} \geq G. \tag{12}$$

By setting up a Lagrangian function Γ with multipliers λ_1 and λ_2, we can derive the following Kuhn-Tucker first-order conditions:

$$\frac{\partial \Gamma}{\partial Z_1} = -\theta\left(Z_1^* - Z_0\right) - \tfrac{\delta r}{Z} + \delta\eta L_m^{\beta}\left(1-\beta\right) - \lambda_1\psi\left(Z_1^* - Z_0\right) + \lambda_2\left(t\beta L_m^{\beta} + \tfrac{r}{Z}\right) \leq 0$$

$$\frac{\partial \Gamma}{\partial \lambda_1} = tZ_0\beta L_m^{\beta} + \tfrac{Z_0 r}{Z} - G - \psi\left(Z_1^* - Z_0\right)^2/2 \geq 0 \tag{13}$$

$$\frac{\partial \Gamma}{\partial \lambda_2} = tZ_1\beta L_m^{\beta} + \frac{Z_1 r}{\bar{Z}} - G \geq 0 \tag{14}$$

$$\frac{\partial \Gamma}{\partial \lambda_1} \cdot \lambda_1 = 0; \frac{\partial \Gamma}{\partial \lambda_2} \cdot \lambda_2 = 0; \quad \frac{\partial \Gamma}{\partial Z_1} \cdot Z_1 = 0$$

The third line shows the complementary slackness conditions. The second-order condition for maximum is fulfilled since the Lagrangian function is strictly concave in the relevant range $Z_1 > 0$.

The problem above implies that we can characterize the set of solutions in the following Lemma:

Lemma 1 *The maximization problem in (12) has four potential unique solutions:*

$$Z_1^* : \begin{cases} = \tilde{Z}_1^- & \text{if } Z_1^{opt} \leq \tilde{Z}_1^- & \text{and } \lambda_1 = 0, \ \lambda_2 > 0 & \text{(i)} \\ = \hat{Z}_1^- > \tilde{Z}_1^- & \text{if } Z_1^{opt} \leq \hat{Z}_1^- & \text{and } \lambda_1 = \hat{\lambda}^- > 0, \ \lambda_2 = 0 & \text{(ii)} \\ = Z_1^{opt} & \text{if } \hat{Z}_1^- < Z_1^{opt} < \hat{Z}_1^+ & \text{and } \lambda_1 = 0, \ \lambda_2 = 0 & \text{(iii)} \\ = \hat{Z}_1^+ & \text{if } Z_1^{opt} \geq \hat{Z}_1^+ & \text{and } \lambda_1 = \hat{\lambda}^+ > 0, \ \lambda_2 = 0 & \text{(iv)} \end{cases}$$

where $\tilde{Z}_1^-$, $\hat{Z}_1^-$ *and* $\hat{Z}_1^+$ *are given by (9), (10) and (11) respectively,*

$$Z_1^{opt} = Z_0 + \frac{\delta}{\theta}\left(\eta L_m^{\beta}(1-\beta) - \frac{r}{\bar{Z}}\right) \tag{15}$$

and

$$\hat{\lambda}^- = \left(\frac{Z^{opt} - Z_1^-}{\hat{Z}_1^- - Z_0}\right)\frac{\theta}{\psi}; \ \hat{\lambda}^+ = \left(\frac{Z^{opt} - Z_1^+}{\hat{Z}_1^+ - Z_0}\right)\frac{\theta}{\psi}; \ \lambda_2 = \frac{\theta\left(\tilde{Z}_1^- - Z^{opt}\right)}{t\beta L_m^{\beta} + \frac{r}{\bar{Z}}} \tag{16}$$

Proof. The results follow from straightforward manipulations of the first-order conditions. ■

The first two solutions (i)-(ii) represent lower boundary extrema where the ruling elite disinvests in property rights institutions as much as they can afford, (iii) is an interior maximum with positive or negative investment, and (iv) is an upper boundary solution where the ruling elite uses all available government means for positive investment.

The term Z_1^{opt} is given by the unconstrained maximum $\frac{U_r}{\partial Z_1}\Big|_{Z_1 = Z_1^{opt}} = 0$. This value might or might not be attainable depending on the level of affordable reforms. The Lagrangian multipliers $\hat{\lambda}^-$, $\hat{\lambda}^+$ and λ_2 reflect the

shadow value of net government revenue in case of constrained boundary solutions.

The solutions derived in Lemma 1 might be used to express the following intuitive results:

Proposition 1 *(a) The ruling elite is more likely to strengthen (weaken) property rights institutions if η and L_m are high (low) and if r and θ are low (high). (b) In the case of positive boundary solutions, the change in the strength of property rights institutions in either direction increases with t, r, L_m and Z_0 and decreases with G and ψ.*

Proof. (a) Whether institutions are strengthened or weakened is determined by the sign of $Z_1^{opt} - Z_0 = \frac{\delta}{\theta}\left(\eta L_m^{\beta}(1-\beta) - \frac{r}{Z}\right)$. A high η and L_m and a low r imply that a positive sign is likely, and vice versa.

(b) From (9), (10) and (11), we know that the greatest feasible institutional change in either direction is $\hat{Z}_1^{+} - Z_0 = Z_0 - \hat{Z}_1^{-} = \sqrt{2\left(tZ_0\beta L_m^{\beta} + \frac{Z_0 r}{Z} - G\right)/\psi} > 0$, while the minimum feasible level of Z_1 is $\tilde{Z}_1^{-} = G/t\beta L_m^{\beta} + \frac{r}{Z} > 0$. From these expressions, it is easily seen that the result in (b) applies. ■

In the case of $Z_1^* = \tilde{Z}_1^{-}$ or $\hat{Z}_1^{-}$ as in (i) and (ii) of Lemma 1, the ruling elite is totally committed to destroying existing institutions. The proposition shows that this scenario might arise when the ruling elite's interests in the modern η sector are small and when the rent flow r is large. The greater are r, t, L_m and Z_0 at this equilibrium, the stronger is the government budget and the ruling elite can afford an even greater weakening of institutions. This 'income effect' might however be balanced by the fact that a weakening of property rights is less likely if L_m increases according to (a). A greater G - i.e. a smaller autonomy for the ruling elite - will in this equilibrium mean a smaller deterioration in institutions.

When we have an interior solution such that $Z_1^* = Z_1^{opt}$, then the optimal level of institutions in period 1 will depend positively on the 'inherited' level of institutions in period 0. However, if we look at institutional change as in Proposition 1, it is easily seen that a weakening of property rights is more likely if the rent flow r is large.[12] In other words, the model predicts that countries with a relatively substantial rent flow at independence should face a worsening of property rights institutions. The logic is of course that high rents will imply that a kleptocratic ruling elite's opportunity costs of

[12] More precisely, there will be a disinvestment in institutions if $r > \eta L_m^{\beta}(1-\beta)\bar{Z}$.

installing stronger property rights are high since a strong protection against expropriation will mean lower rents for themselves. However, apart from this 'substitution effect' of an increase in r, rents also have an income effect via the budget constraint, as discussed above.

In the interior solution, Z_1^* further increases with η and L_m. The greater the ruling elite's interests in the modern sector and the greater the value generated from this sector, the greater is the likelihood of a positive change in second-period property rights institutions, as one might expect.

In the upper boundary solution where $Z_1^* = \hat{Z}_1^+$, the ruling elite spends every available penny in the government budget on improving property rights. The reason is simply that their marginal utility of Z_1 is positive in the whole feasible range. This 'good' outcome is therefore more likely when the modern sector is relatively important for the ruling elite's personal enrichment, i.e. when η and L_m are high and r is low.

From (11), we see that Z_1^* increases with r in the upper boundary solution due to the income effect since an increase in r shifts the budget constraint further out. However, an increase in r also decreases the marginal utility of property rights investments, which is the force behind the substitution effect of r. At a certain level of r, an interior solution will arise in which case an increase in r will lower the optimal level of property rights.[13] Thus, all else equal, the income effect of increases in r will dominate in the upper boundary solution if such increases start at very low levels of r, whereas beyond a certain level, the substitution effect of a higher r will dominate. It is also interesting to note that in this good equilibrium, a smaller fiscal autonomy for the ruling elite (a higher G) will imply a lower level of property rights institutions since the discretionary part of the budget shrinks. Similarly, high costs of institutional change - reflected by high levels of θ and ψ - will inevitably result in small deviations from Z_0.[14]

If total output in the country is measured as modern production plus the official or non-diverted flow of rents from the natural resource sector, then we can write $Y_t = Q_t + Z_t r_t / \bar{Z}$. The growth rate of the economy in the case of an interior solution will therefore be

$$\frac{Y_1 - Y_0}{Y_0} = \frac{Z^{opt} - Z_0}{Z_0} = \frac{\delta}{Z_0 \theta} \left(\eta L_m^{\beta} (1 - \beta) - \frac{r}{Z} \right) \gtreqless 0. \tag{17}$$

[13] This level of r is reached when $\lambda^+ = 0$ which happens when $Z_1^{opt}(r, \cdot) = \hat{Z}_1^+(r, \cdot)$.

[14] The equations above show that both $Z_1^{opt} - Z_0$ and $\hat{Z}_1^+ - Z_0 = Z_0 - \hat{Z}_1^-$ will approach zero as θ and ψ approach infinity.

The growth rate is thus negatively related to the flow of rents r. The negative marginal effect on growth of an increase in r decreases in absolute terms with Z_0, implying that countries with relatively good initial institutions should experience smaller adverse effects of a high r.

The corresponding growth rate for a country that optimally fully utilizes the government budget for positive investment is

$$\frac{Y_1 - Y_0}{Y_0} = \frac{\hat{Z}_1^+ - Z_0}{Z_0} = \frac{\sqrt{2\left(tZ_0\beta L_m^{\beta} + \frac{Z_0 r}{\bar{Z}} - G\right)/\psi}}{Z_0} > 0. \tag{18}$$

As mentioned above, for this category of countries in the good equilibrium, natural resources do not constitute a curse. On the contrary, growth will increase with an increase in r. These findings perhaps contribute to explaining the results from the empirical growth literature that countries with good institutions seem to be able to escape the 'curse of natural resources' (Mehlum et al, 2006). However, as shown above, beyond a certain level of r, an interior solution will arise and the (institutions-weakening) substitution effect will start to dominate.

4 Extensions

In this section, we will extend our basic model to account for the effects of endogenous labor supply, natural resource booms and declines, foreign aid, trade liberalization, and impediments to institutional efficacy.

4.1 Endogenous labor supply

In the derivations above, labor supply L_m was assumed to be exogenously given and fixed throughout the two periods. This is not a totally satisfactory assumption since it can be easily imagined that labor supply should depend on for instance the tax rate and, perhaps more interestingly, on the quality of institutions in the modern sector. In this section, we will therefore derive labor supply endogenously and analyze how this alters the results from the previous section. We will assume that the decisions about institutional choice and labor supply are made as in a sequential game with the ruling elite acting as a leader whose supply of property rights institutions is taken as given by the workers.

Let us assume that the ruling elite's objective function is as in (6). Let us also postulate that there is only one group of workers with the linear utility

function

$$U_l\left(L_{m,t}\right) = \left(1-t\right) Z_t \beta L_{m,t}^{\beta} + \gamma\left(L - L_{m,t}\right) + G \quad \text{for } t = (0,1)\,.$$

In each of the two periods, the working part of the population receives utility from after-tax labor income $\left(1-t\right) Z_t \beta L_{m,t}^{\beta}$, from leisure or informal household production $\gamma\left(L - L_{m,t}\right)$, and from the public goods G provided by the ruling elite. The only new parameters here are L which is the fixed total endowment of labor resources, and $\gamma > 0$ that reflects the marginal utility (or productivity) of household production. Note that property rights do not affect the output of informal household production.[15]

The workers maximize U_l with labor supply $L_{m,t}$ as the control variable, taking Z_t as given. From the usual first-order conditions, we find that the equilibrium levels will be

$$L_{m,t}^{*} = \left(\frac{\left(1-t\right) Z_t \beta^2}{\gamma}\right)^{\frac{1}{1-\beta}}. \tag{19}$$

Thus labor supply in period t will be positively associated with the strength of property rights institutions in period t. This should make sense; the greater the levels of Z_t, the greater the worker's marginal product and the greater their or her labor supply to the modern sector. Conversely, the greater the utility from household production γ, the lower the supply of modern sector labor.

The ruling elite realizes by backward induction what labor effort that will be supplied to the modern sector and takes this level as given in their own optimization. This means that the ruling elite's utility function becomes

$$U_r = \sum_{t=0}^{1} \delta^t \left(\left(1 - \tfrac{Z_t}{Z}\right) r + \eta\left(1-\beta\right) \beta^{\frac{2\beta}{1-\beta}} Z_t^{\frac{1}{1-\beta}} \left(\tfrac{(1-t)}{\gamma}\right)^{\frac{\beta}{1-\beta}}\right) - \frac{\theta\left(Z_1 - Z_0\right)^2}{2}.$$

The first period government budget constraint is still that

$$G + \frac{\psi\left(Z_1 - Z_0\right)^2}{2} \leq t Z_0^{\frac{1}{1-\beta}} \beta^{\frac{1+\beta}{1-\beta}} \left(\tfrac{(1-t)}{\gamma}\right)^{\frac{\beta}{1-\beta}} + \tfrac{Z_0 r}{Z} \tag{20}$$

which in turn implies that the highest attainable level of institutional change

[15] This could be the case if informal production does not require significant investment (see, eg, Besley, 1995). A similar assumption is made in Olsson and Congdon Fors (2004).

is

$$\hat{Z}_1^+ - Z_0 = Z_0 - \hat{Z}_1^- = \sqrt{\frac{2\left(tZ_0^{\frac{1}{1-\beta}}\beta^{\frac{1+\beta}{1-\beta}}\left(\frac{(1-t)}{\gamma}\right)^{\frac{\beta}{1-\beta}} + \frac{Z_0 r}{\bar{Z}} - G\right)}{\psi}} > 0 \tag{21}$$

while the second period budget constraint remains as:

$$G \leq tZ_1^{\frac{1}{1-\beta}}\beta^{\frac{1+\beta}{1-\beta}}\left(\frac{(1-t)}{\gamma}\right)^{\frac{\beta}{1-\beta}} + \frac{Z_1 r}{\bar{Z}}. \tag{22}$$

When the optimization problem is changed in this way, the Kuhn-Tucker first-order conditions become more complicated (see Appendix 1). As visual inspection should make clear, the solution to this optimization problem will depend to a great extent on the levels of the labor elasticity parameter β as well as on the other parameters of the model. In order to simplify the analysis without losing focus on the essentials, we will make the following assumptions for the remainder of the analysis:

$$\beta = 2/3; \quad \delta = \theta = \psi = \gamma = 1. \tag{23}$$

The assumption that $\beta = 2/3$ is standard, i.e. that the share of labour in production is 2/3.[16] The assumption that the remaining parameters are equal to one is a simplification, which in many cases will be relaxed in the subsections below. The greatest attainable change in property rights is thus

$$\hat{Z}_1^+ - Z_0 = Z_0 - \hat{Z}_1^- = \sqrt{2\left(tZ_0^3 c\,(1-t)^2 + \frac{Z_0 r}{\bar{Z}} - G\right)} \tag{24}$$

where $c = \frac{32}{243}$, while $\tilde{Z}_1^-$ is the value of Z_1 that satisfies:

$$t\left(\tilde{Z}_1^-\right)^3 c\,(1-t)^2 + \frac{\tilde{Z}_1^- r}{\bar{Z}} - G = 0. \tag{25}$$

Further, setting $\beta = 2/3$ means that the ruling elite's utility function above becomes a cubic function of Z_1. Unlike in the exogenous labour supply case, the second-order condition for maximum is not necessarily fulfilled in the endogenous labour supply case since the Lagrangian function is not strictly concave in the relevant range $Z_1 > 0$. Rather, as shown in the Appendix,

[16] See for instance Krueger and Lindahl (2001) for a discussion of the most plausible 'world' level.

there are two extreme points, given by the expression

$$Z_i^{l,opt} = \begin{cases} Z_1^{l,\max} = \frac{1-\sqrt{\left(1-4\eta d(1-t)^2\left(Z_0-\frac{r}{Z}\right)\right)}}{2\eta d(1-t)^2} \\ Z_1^{l,\min} = \frac{1+\sqrt{\left(1-4\eta d(1-t)^2\left(Z_0-\frac{r}{Z}\right)\right)}}{2\eta d(1-t)^2} \end{cases} \tag{26}$$

where $d = \frac{16}{81}$. Obviously, we can disregard $Z_1^{l,\min}$ as a potential solution to the ruling elite's optimization problem. Upon inspection of (26), it is clear that we will have different types of solutions for $Z_1^{l,\max}$ depending on the size of the expression under the square root sign. Appendix 2 characterizes in detail the solutions for $Z_1^{l,\max}$ and for Z_1^*. The analytically most interesting scenario arises when $Z_0 - \frac{r}{Z} > 0$ and the expression under the square root sign ranges between zero and one, which ensures that $Z_1^{l,\max} > 0$. Figures 1a and 1b show two types of solutions with this feature. In these cases, it is also evident that $Z_1^{l,\max} < Z_1^{l,\min}$. The local minimum also provides us with important information: At levels higher than $Z_1^{l,\min}$, investment in property rights once again starts to yield utility gains for the ruling elite.

Now that we have established the local maximum and the three constrained cases, it remains to determine what the optimal solution to the ruling elite's maximization problem will actually be. The optimal solution depends on the relationship between the constrained solutions and the unconstrained local maximum, and the utility derived by the ruling elite from each. In Appendix 2, all possible equilibria and the conditions associated with them are characterized formally.

On a more intuitive level, there are as before four potential solutions: (i) $Z_1^* = \tilde{Z}_1^-$, (ii) $Z_1^* = \hat{Z}_1^-$, (iii) $Z_1^* = Z_1^{l,\max}$, or (iv) $Z_1^* = \hat{Z}_1^+$. In (i) and (ii), the ruling elite weakens property rights as much as they can afford, whereas an interior maximum is optimally chosen in (iii). Whether the latter involves a strengthening or a weakening of institutions is not clear but depends on the parameters. This kind of equilibrium (with a worsening of property rights) is illustrated in Figure 1a. (iv) shows the upper boundary solution, which might arise in four different cases, for instance when $Z_1^{l,\max} > \hat{Z}_1^+$. A noteworthy feature is further that $Z_1^{l,\max}$ might not be the optimal choice even when it is affordable. As Figure 1b shows, $\hat{Z}_1^+$ might give a higher utility than $Z_1^{l,\max}$ since the utility function starts increasing again beyond the minimum.

Figure 1a: Optimal weakening of property rights with endogenous labor supply ($\lambda_2 = 0$).

Interior maximum is optimal: $Z_1^* = Z_1^{l,\max} < Z_0$

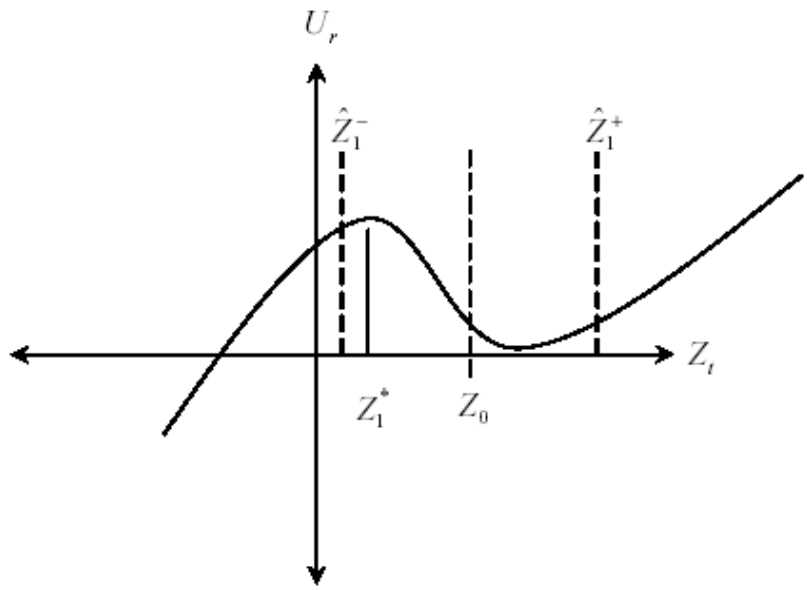
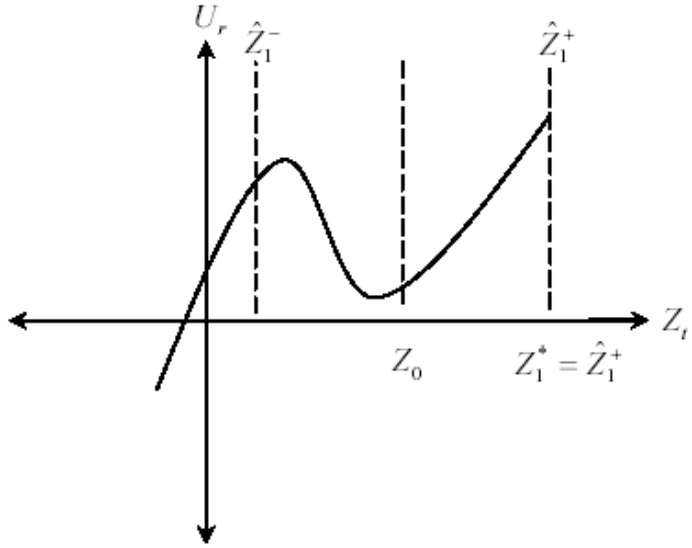


Figure 1b: Optimal strengthening of property rights with endogenous labor supply ($\lambda_2 = 0$).

Upper boundary is optimal: $Z_1^* = \hat{Z}_1^+ > Z_0 > Z_1^{l,\max}$; $U_r\left(\hat{Z}_1^+\right) > U_r\left(Z_1^{l,\max}\right)$



If we are to make a general characterization, the results in the endogenous labor supply case will be similar to those above:

Proposition 2 *(a) With endogenous labor supply, the ruling elite is more likely to strengthen (weaken) property rights institutions if η and Z_0 are high (low) and if r and t are low (high). (b) In the case of positive boundary solutions, the change of property rights institutions in either direction increases with r and Z_0 and with t if $t < 1/3$, and decreases with G.*

Proof. (a) Whether institutions are strengthened or weakened is determined by the sign of $Z_1^{l,\max} - Z_0 = \frac{1}{2\eta d(1-t)^2}\left(1 - \sqrt{\left(1 - 4\eta d\left(1-t\right)^2\left(Z_0 - \frac{r}{Z}\right)\right)}\right) - Z_0$. A straightforward manipulation of this expression shows that $Z_1^{l,\max} - Z_0 > 0$ if $1 - 2\eta d\left(1-t\right)^2 Z_0 > \sqrt{\left(1 - 4\eta d\left(1-t\right)^2\left(Z_0 - \frac{r}{Z}\right)\right)}$. By squaring both sides, we receive $1 - 4\eta d\left(1-t\right)^2 Z_0 + \left(2\eta d\left(1-t\right)^2 Z_0\right)^2 > 1 - 4\eta d\left(1-t\right)^2\left(Z_0 - \frac{r}{Z}\right)$, which in turn implies that $\eta d\left(1-t\right)^2 Z_0^2 > \frac{r}{Z}$. Thus $Z_1^{l,\max} - Z_0 > 0$ if $\eta d\left(1-t\right)^2 Z_0^2 > \frac{r}{Z}$, which is the essence of (a).

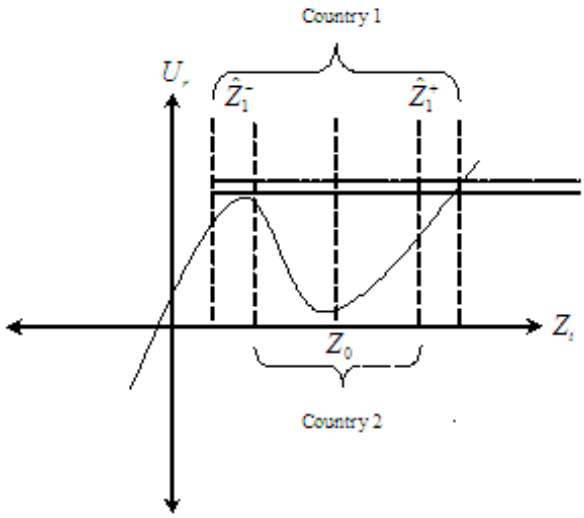
(b) From (25) and (24), we know that the greatest feasible institutional change in either direction is $\hat{Z}_1^{+} - Z_0 = Z_0 - \hat{Z}_1^{-} = \sqrt{2\left(tZ_0^3 c\left(1-t\right)^2 + \frac{Z_0 r}{Z} - G\right)} > 0$, while the minimum feasible level of Z_1 is defined by $t\left(\tilde{Z}_1^{-}\right)^3 c\left(1-t\right)^2 + \frac{\tilde{Z}_1^{-} r}{Z} - G = 0$. From these expressions, it is easily seen that the results in (b) regarding r, Z_0, and G apply. Since $t < 1$, the multiplicative term $t\left(1-t\right)^2$ achieves its maximum at $t = 1/3$. ■

As before, positive (negative) changes are more likely if η is large (small) and r is small (large). If the imbalance between the incentives for strengthening property rights $\left(\eta d\left(1-t\right)^2 Z_0^2\right)$ and the incentives for weakening them $\left(r/\bar{Z}\right)$ is large in either direction, a boundary solution is more likely where the results in (b) will apply. A difference from the previous section is that a strengthening of property rights is more likely if the level of inherited institutions Z_0 is high. This implies a kind of path dependence: Countries with strong property rights at independence will invest in even stronger rights whereas the reverse will be true for more weakly institutionalized colonies. The logic is that better initial institutions means that the modern sector is relatively more productive, so that the losses from weakening institutions will be greater, and there will be a greater incentive to strengthen property rights. Further, since r and Z_0 affect both the unconstrained and the constrained so-

lutions, they might have both income and substitutions effects, as discussed above.

The proposition shows that a rise in η only has an impact on the maximum whereas G only affects the constrained solutions. An interesting case might occur if two otherwise identical countries have slightly different levels of required public goods, G. Let us assume that for some reason, one of the countries (country 1) gives a larger discretionary power to the ruling elite than in country 2 so that $G^1 < G^2$. Then, if the situation is as in Figure 2, this means that country 1 will optimally be at the upper boundary solution whereas country 2 will be stuck at the lower boundary. This illustrates the notion that even small differences between countries might give drastically different outcomes regarding the optimal structure of institutions.

Figure 2: A high and a low equilibrium level of property rights ($\lambda_2 = 0$). $Z_1^* = \hat{Z}_1^-$ if $G = G^2 > G^1$. $Z_1^* = \hat{Z}_1^+$ if $G = G^1$.



4.2 Natural resource booms and declines

We have assumed that $r_0 = E_0(r_1) = r$, i.e. the rents from natural resources in the second period are expected to equal the rents in the first period. In this section, we analyze the effects of $r_0 \neq r_1$ on ruling elite's optimal choice

case $E_0(r_1) = r_1$, or unanticipated, in which case $E_0(r_1) = r_0$. Starting with the first case, note that the first period budget constraint will be identical to that in (24) with $r = r_0$, while the ruling elite will maximize second period utility taking r_1 into account, i.e.

$$Z_1^{r,\max} = \frac{1 - \sqrt{\left(1 - 4\eta d(1-t)^2\left(Z_0 - \frac{r_1}{\bar{Z}}\right)\right)}}{2\eta d(1-t)^2} \tag{27}$$

and the second period budget constraint will now be

$$t\left(\tilde{Z}_1^-\right)^3 c(1-t)^2 + \frac{\tilde{Z}_1^- r_1}{\bar{Z}} - G = 0. \tag{28}$$

If a natural resource boom is anticipated, we have $r_1 > r_0$. The result is that $Z_1^{r,\max}$ will occur at a lower level of property rights institutions while at the same time $Z_1^{r,\min}$ will occur at a higher level. Because r_0 does not change, there is no first period income effect from the natural resource boom, while there is a second period income effect. The result is that Z_1^* will occur at a lower level of property rights institutions in the case of an interior solution. The effect on the constrained solutions is less straightforward.

The ruling elite does not take the true value of natural resource rents into account when the shock is unanticipated. As a result, neither the local maximum nor the budget constraints change.

4.3 Foreign aid

So far we have assumed that the ruling elite can only finance changes in property rights institutions through domestic means. There is, however, a possibility that the ruling elite receives development aid from foreign donors. Ideally, this aid would be ear-marked for institutional development, yielding the following upper budget constraint

$$\hat{Z}_1^+ = Z_0 + \sqrt{2\left(tZ_0^3 c(1-t)^2 + \frac{Z_0 r}{\bar{Z}} + A - G\right)} \tag{29}$$

where A is foreign aid. Given that $Z_1^* = \hat{Z}_1^+$, the effect of aid would therefore be to increase the optimal level of property rights institutions.If $Z_1^* = Z_1^{A,\max}$, on the other hand, the budget constraint is not binding and the ruling elite may choose to forgo the foreign aid in favour of a lower level of institutions.

If it is the case that the ruling elite instead treats the aid as an additional source of rents in both periods, then the effect on the maximum will be

the same as in the case of a natural resource boom as in (27), where $(r + A)$ enters in the place of r_1. This means that aid decreases the strength of property rights institutions in the case of an interior solution. Hence, foreign aid that is not used for investment in property rights institutions could result in worsening institutions and have a negative impact on economic development. This potential negative effect of aid appears in the theoretical model of Acemoglu, Robinson, and Verdier (2003), and seems to be somewhat supported by empirical evidence (Knack, 2000). Note that foreign aid also here increases fiscal revenue (with an amount $Z_0 A/\bar{Z}$) and thus Z_1^* in an upper boundary solution, but to a smaller extent than in (29).

4.4 Trade liberalization

International trade is another factor that may influence the ruling elite's maximization problem. We assume that trade will influence the price of the modern sector output and that a liberalization is usually associated with a fall in modern sector prices. The effect of this price change depends on the timing of the liberalization. Start with the scenario where trade liberalization occurs in the second period, so that $p_0 = 1$, $p_1 < 1$. Here, the first period budget constraints will remain the same as in (24), while the second period budget constraint becomes

$$t\left(\tilde{Z}_1^-\right)^3 p_1^3 c\left(1-t\right)^2 + \frac{\tilde{Z}_1^- r}{\bar{Z}} - G = 0 \tag{30}$$

and the equation for the interior maximum becomes

$$Z_1^{p,\max} = \frac{1 - \sqrt{\left(1 - 2p_1^3 \eta d\left(1-t\right)^2\left(Z_0 - \frac{r}{\bar{Z}}\right)\right)}}{p_1^3 \eta d\left(1-t\right)^2}. \tag{31}$$

We can easily confirm that $Z_1^{l,\max}$ increases with p_1. The intuition is that a lower price level decreases labor supply and makes modern sector production less attractive in relative terms than rent seeking.

If trade liberalization occurs in the first period, and $p_0 = E\left(p_1\right) = p < 1$, then the first period budget constraint becomes

$$\hat{Z}_1^+ - Z_0 = Z_0 - \hat{Z}_1^- = \sqrt{2\left(tZ_0^3 p^3 c\left(1-t\right)^2 + \frac{Z_0 r}{\bar{Z}} - G\right)}. \tag{32}$$

Clearly, a fall in p lowers the maximum feasible change in property rights institutions. However, $Z_1^{l,\max}$ will also increase with p in the same way as in (31).

In other words, trade liberalization that is accompanied by a permanently lower price for modern sector goods will weaken property rights institutions if we initially have an interior or an upper boundary solution. The results are of course reversed if a trade liberalization causes an increase in modern sector prices.

Another potential impact of trade liberalization is to increase the volume of natural resource extraction, hence increasing the rents from natural resources.[17] In this case, the effect of trade liberalization will be the same as in the case of a natural resource boom as in (27).

4.5 Impediments to institutional efficacy

Former colonies typically face many obstacles to institutional change, such as low population density, a complex geography, and great ethnic diversity (see for instance Herbst, 2000). These factors can influence the ruling elite's optimal choice of property rights institutions in two ways. First, it may be that $\theta > 1$ (rather than $\theta = 1$ as assumed previously). This corresponds to a greater amount of effort being required on the ruling elite's part to bring about institutional change, with the local maximum defined by

$$Z_1^{\theta,\max} = \frac{\theta - \sqrt{\left(\theta^2 - 2\eta d\left(1-t\right)^2\left(\theta Z_0 - \frac{r}{Z}\right)\right)}}{\eta d\left(1-t\right)^2}. \tag{33}$$

The effect of an increase in θ is to make any change, be it investment or disinvestment, less attractive.[18] Another possibility is that these obstacles cause $\psi > 1$. This corresponds to an increase in the cost of institutional change via the first period government budget. In this case, the budget constraint is as given in (21). It is directly evident that an increase in ψ will lower the amount of institutional change that is attainable.[19] In the worst case, high costs of institutional change may compel a ruling elite to choose a low property rights equilibrium over a high property rights equilibrium.

We have assumed that Z increases modern sector output at a 1:1 ratio.

[17] For example, Chichilnisky (1994) presents a model of international trade that demonstrates that countries with poorly-defined property rights will appear to have a comparative advantage in resource-intensive production, even when technology, endowments and preferences are the same in all countries. This can, in turn, lead to overextraction of natural resources in the countries with low levels of property rights.

[18] However, the sign of the partial derivative of (33) with respect to θ can be either positive or negative.

[19] Whether this results in higher or lower level of Z_1^* depends on whether the ruler optimally strengthens or weakens property rights institutions.

It is possible, however, that the effect of Z on modern sector output is less than unity. There is some theoretical support for the notion that the effectiveness of property rights on modern sector output is positively related to the state of technology (Demsetz, 1967; Alchian and Demsetz, 1973), so that low technology may decrease the effectiveness of property rights on modern sector output. Other potential factors include low levels of human capital accumulation, missing markets, limited access to credit, a high degree of ethnic fractionalization and geographical impediments. In this case, output in the modern sector would be $\varepsilon^3 Z_0^3 d\left(1-t\right)^2$, where $\varepsilon < 1$. This in turn would alter the optimum solution as follows

$$Z_1^{\varepsilon,\max} = \frac{1 - \sqrt{\left(1 - 2\varepsilon^3 \eta d\left(1-t\right)^2 \left(\theta Z_0 - \frac{r}{Z}\right)\right)}}{\varepsilon^3 \eta d\left(1-t\right)^2} \tag{34}$$

while the budget constraints become

$$t\left(\tilde{Z}_1^-\right)^3 \varepsilon^3 c\left(1-t\right)^2 + \frac{\tilde{Z}_1^- r}{Z} - G = 0 \tag{35}$$

and

$$\hat{Z}_1^+ - Z_0 = Z_0 - \hat{Z}_1^- = \sqrt{2\left(tZ_0^3 \varepsilon^3 c\left(1-t\right)^2 + \frac{Z_0 r}{Z} - G\right)}. \tag{36}$$

The effect of $\varepsilon < 1$ is to lower the maximum feasible investment in property rights institutions, while at the same time lowering the level of property rights institutions at which the maximum occurs. Therefore, property rights institutions will be weakened if we initially have an interior or an upper boundary solution when Z increases modern sector output at less than a 1:1 ratio. Finally, an increase in γ, the marginal productivity of household production, will have the opposite general effect of ε on the budget constraints and the unconstrained optima.[20]

The above impediments to institutional efficacy all have in common that they restrict the scope of attainable institutional change compared to what would otherwise be the case. Further, in the case when output is adversely affected, the ruling elite may be more inclined to choose a low level of property rights institutions.

[20] The only difference being that γ will occur in quadratic form rather than cubic, as is the case with ε.

5 Conclusion

In this article, we have attempted to model the decision process of property rights (dis)investment by an autocratic ruling elite. We have been motivated by the previous literature that has emphasized the crucial role institutions play in economic development, as well as by institutional changes that have taken place in former European colonies since independence. Further, the model has been motivated by the literature on the 'natural resource curse' and the observation that many resource-poor countries in Asia have shown considerably stronger economic performance than resource-rich African countries despite similar initial levels of institutional quality.

The main insight of our model is the existence of a potential trade-off for an autocratic elite between strong institutions of private property - which increase revenue from the modern sector - and weaker property rights that facilitate the personal appropriation of rents from a natural resource sector. We show that even a completely self-interested ruling elite may have incentives to strengthen property rights if the modern sector is relatively profitable. Additionally, the model retains a component of institutional persistence, which is present in much of the literature on the origins of institutions in former colonies. Although we have assumed that the ruling elite is only interested in personal enrichment, one could easily alter the model to fit an altruistic ruling elite. In this case, the rent appropriation part of the utility function would disappear, and η would measure the ruling elite's willingness to expanding the modern sector. The cost of an investment would then set the limit to how much the elite could invest; variations in institutional investment would thus depend on initial levels of institutions.

Although the article discusses a number of extensions to the basic model such as the impact of foreign aid and trade liberalization, we believe that several other aspects might be fruitfully analyzed within the framework outlined above. For instance, we have only briefly touched upon the issue of why larger former colonies seem to have been disadvantaged in terms of institutional development. An econometric analysis is clearly needed in order to understand the exact channels of causation.

A further line of inquiry might be the impact of stronger property rights on human capital accumulation, an issue that we have not dealt with at all here. Neither have we explicitly considered the possibility that the ruling elite initiates other types of institutional changes in the modern sector that are detrimental to the economy, such as the pursuit of import substitution

strategies. However, we conjecture that the opposing forces of a modern and a natural resource sector as modelled in this article may shed some light also on this issue. All else equal, it seems likely that a newly independent regime with a strong flow of mineral rents and a sense of self-sufficiency is more inclined to adopt inward-oriented policies than a resource-poor country. Clearly, the 'curse of natural resources' is a multi-faceted phenomenon that deserves further attention.

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Appendix

A1

The Lagrangian for this problem is

$$\begin{aligned}\Gamma^{l} = &\sum_{t=0}^{1}\delta^{t}\left(\left(1-\tfrac{Z_t}{\overline{Z}}\right)r+\eta\left(1-\beta\right)\beta^{\frac{2\beta}{1-\beta}}Z_t^{\frac{1}{1-\beta}}\left(\tfrac{(1-t)}{\gamma}\right)^{\frac{\beta}{1-\beta}}\right)-\frac{\theta\left(Z_1-Z_0\right)^2}{2}\\ &+\lambda_1\left(tZ_0^{\frac{1}{1-\beta}}\beta^{\frac{1+\beta}{1-\beta}}\left(\tfrac{(1-t)}{\gamma}\right)^{\frac{\beta}{1-\beta}}+\tfrac{Z_0 r}{\overline{Z}}-G-\frac{\psi\left(Z_1-Z_0\right)^2}{2}\right)\\ &+\lambda_2\left(tZ_1^{\frac{1}{1-\beta}}\beta^{\frac{1+\beta}{1-\beta}}\left(\tfrac{(1-t)}{\gamma}\right)^{\frac{\beta}{1-\beta}}+\tfrac{Z_1 r}{\overline{Z}}-G\right)\end{aligned}$$

with the Kuhn-Tucker first-order conditions

$$\begin{aligned}\frac{\partial\Gamma}{\partial Z_1} = &-\tfrac{\delta}{\overline{Z}}r+\delta\eta\beta^{\frac{2\beta}{1-\beta}}Z_1^{\frac{\beta}{1-\beta}}\left(\tfrac{(1-t)}{\gamma}\right)^{\frac{\beta}{1-\beta}}-\theta\left(Z_1-Z_0\right) \qquad (37)\\ &-\lambda_1\psi\left(Z_1-Z_0\right)-\lambda_2\left(\beta^{\frac{1+\beta}{1-\beta}}\left(\tfrac{1}{1-\beta}\right)tZ_1^{\frac{\beta}{1-\beta}}\left(\tfrac{(1-t)}{\gamma}\right)^{\frac{\beta}{1-\beta}}+\tfrac{r}{\overline{Z}}\right)\leq 0\end{aligned}$$

$$\frac{\partial\Gamma}{\partial\lambda_1} = tZ_0^{\frac{1}{1-\beta}}\beta^{\frac{1+\beta}{1-\beta}}\left(\tfrac{(1-t)}{\gamma}\right)^{\frac{\beta}{1-\beta}}+\tfrac{Z_0 r}{\overline{Z}}-G-\frac{\psi\left(Z_1-Z_0\right)^2}{2}\geq 0 \qquad (38)$$

$$\frac{\partial\Gamma}{\partial\lambda_2} = tZ_1^{\frac{1}{1-\beta}}\beta^{\frac{1+\beta}{1-\beta}}\left(\tfrac{(1-t)}{\gamma}\right)^{\frac{\beta}{1-\beta}}+\tfrac{Z_1 r}{\overline{Z}}-G\geq 0 \qquad (39)$$

and the complementary slackness conditions

$$\frac{\partial\Gamma}{\partial\lambda_1}\cdot\lambda_1 = 0;\quad \frac{\partial\Gamma}{\partial\lambda_2}\cdot\lambda_2;\quad \frac{\partial\Gamma}{\partial Z_1}\cdot Z_1 = 0.$$

Given the parameter simplifications, (37) implies that the interior solutions are

$$Z_i^{l,opt} = \begin{cases} Z_1^{l,\max} = \frac{1}{2\eta d(1-t)^2}\left(1-\sqrt{\left(1-4\eta d\left(1-t\right)^2\left(Z_0-\frac{r}{\overline{Z}}\right)\right)}\right)\\ Z_1^{l,\min} = \frac{1}{2\eta d(1-t)^2}\left(1+\sqrt{\left(1-4\eta d\left(1-t\right)^2\left(Z_0-\frac{r}{\overline{Z}}\right)\right)}\right)\end{cases}$$

and that the Lagrangian multipliers are

$$\hat{\lambda}^{+} = \frac{\eta d\left(\hat{Z}_1^{+}\right)^2(1-t)^2-\frac{r}{\overline{Z}}}{\left(\hat{Z}_1^{+}-Z_0\right)}-1$$

$$\hat{\lambda}^{-} = \frac{\eta d \left(\hat{Z}_1^{-}\right)^2 (1-t)^2 - \frac{r}{Z}}{\left(\hat{Z}_1^{-} - Z_0\right)} - 1.$$

and

$$\hat{\lambda}_2 = \frac{\frac{r}{Z} - \eta d \left(\tilde{Z}_1\right)^2 (1-t)^2 + \left(\tilde{Z}_1 - Z_0\right)}{\eta e \left(\tilde{Z}_1\right)^2 t (1-t)^2 + \frac{r}{Z}}$$

A2

The expression in (26) implies that there are four distinct possibilities for the local maximum:

$$Z_1^{l,\max} : \begin{cases} = 0 & \text{if } \left(Z_0 - \frac{r}{Z}\right) = 0 & \text{(i)} \\ > 0 & \text{if } 0 < 4\eta d (1-t)^2 \left(Z_0 - \frac{r}{Z}\right) < 1 & \text{(ii)} \\ < 0 & \text{if } \left(Z_0 - \frac{r}{Z}\right) < 0 & \text{(iii)} \\ \nexists & \text{if } 4\eta d (1-t)^2 \left(Z_0 - \frac{r}{Z}\right) > 1 & \text{(iv)} \end{cases}$$

The set of solutions to the maximization problem defined by the Lagrangian function are:

$$
Z_1^*: \begin{cases}
= \tilde{Z}_1^- & \text{if } Z_1^{l,\max} < \tilde{Z}_1^- & \text{and } \lambda_1 = 0, \\
& & \lambda_2 > 0, \\
& & U_r\left(\tilde{Z}_1^-\right) > U_r\left(\hat{Z}_1^+\right) \\
= \hat{Z}_1^- > \tilde{Z}_1^- & \text{if } Z_1^{l,\max} \leq \hat{Z}_1^- & \text{and } \lambda_1 = \hat{\lambda}^- > 0, \\
& & \lambda_2 = 0, \\
& & U_r\left(\hat{Z}_1^-\right) > U_r\left(\hat{Z}_1^+\right) \\
= Z_1^{l,\max} & \text{if } \hat{Z}_1^- < Z_1^{l,\max} < \hat{Z}_1^+ & \text{and } \lambda_1 = 0, \\
& & \lambda_2 = 0, \\
& & U_r\left(Z_1^{l,\max}\right) > U_r\left(\hat{Z}_1^+\right) \\
= \hat{Z}_1^+ & \begin{cases}
\text{if } Z_1^{l,\max} \leq \hat{Z}_1^- & \text{and } \lambda_1 = \hat{\lambda}^+ > 0, \\
& \lambda_2 = 0, \\
& U_r\left(\hat{Z}_1^-\right) < U_r\left(\hat{Z}_1^+\right) \\
\text{or} & \\
\text{if } Z_1^{l,\max} > \hat{Z}_1^- & \text{and } \lambda_1 = \hat{\lambda}^+ > 0, \\
& \lambda_2 = 0, \\
& U_r\left(Z_1^{l,\max}\right) < U_r\left(\hat{Z}_1^+\right) \\
\text{or} & \\
\text{if } Z_1^{l,\max} > \hat{Z}_1^+ & \text{and } \lambda_1 = \hat{\lambda}^+ > 0, \\
& \lambda_2 = 0 \\
\text{or} & \\
\text{if } Z_1^{l,\max} \text{ does not exist} & \text{and } \lambda_1 = \hat{\lambda}^+ > 0, \\
& \lambda_2 = 0, \\
& U_r\left(\hat{Z}_1^-\right) < U_r\left(\hat{Z}_1^+\right)
\end{cases}
\end{cases}
$$

(i) (ii) (iii) (iv)

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Congo: The Prize of Predation*

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The article analyzes the war against Mobutu (1996–97) and the more recent war (1998–) in the Democratic Republic of the Congo with particular attention to greed and grievance as motivating factors in these two wars. Whereas the authors' usage of the term 'greed' simply reflects the desire to gain control of natural resource rents, they model 'grievance' as deliberate institutional differences, implemented by the ruler, between the formal and informal sectors. On the basis of quantitative and qualitative evidence, the authors outline a model of a predatory conflict between a kleptocratic ruler and a group of potential predators within a given region. The potential predators choose between peaceful production and predation on the ruling elite, who control the country's natural resource rents. It is shown that institutional grievance between the formal and informal sectors, along with the relative strength of the ruler's defense, play a key role for the initiation of a war. This observation is used to explain the timing of the two wars analyzed in this article. The model also shows that once a war has commenced, the abundance of natural resources and the ruler's kleptocratic tendencies determine conflict intensity. This result is also well in line with experience from the most recent Congolese war.

> They were no colonists; their administration was merely a squeeze, and nothing more, I suspect. They were conquerors, and for that you want only brute force. . . . They grabbed what they could get for the sake of what was to be got. It was just robbery with violence, aggravated murder on a great scale, and men going at it blind – as is very proper for those who tackle a darkness.
>
> (from *Heart of Darkness*, Joseph Conrad, 1899/1989: 21)

Introduction

Joseph Conrad's description from 1899 of King Leopold's Congo Free State applies as well to the predatory war that has been raging in the Democratic Republic of the Congo since 1998. This war alone, fought in remote jungles by a multitude of rebel and national armies from the Great Lakes region, is believed to have taken some 3 million lives and left 2.5 million internally displaced.[1] A primary reason for the continuation of the fighting has been a desire to gain control of easily appropriable and highly valuable natural resources like gold, diamonds, and coltan that Congo is endowed with (United Nations, 2001a,b). Though grievances might have been the spark that initiated the fighting, the real engine of the great war in Central Africa appears to be greed.

Our study is inspired by Collier & Hoeffler's (2001) empirically based distinction between greed and grievance as the two

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[1] See for instance Coakley (2000), Nzongola-Ntalaja (2002), and United Nations (2003a) for estimates of casualties and refugees.

main motivations for civil wars. The grievance aspect is well known and is covered in numerous political science studies. Grievance is usually meant to imply inequality in terms of political and economic rights, inequality of income, and ethnic or religious divisions. Economists – schooled in the tradition of rational, profit-maximizing entrepreneurs – and a growing number of other social scientists have lately come to analyze civil wars as a competition between warlords for the appropriation of valuable resources. In Collier & Hoeffler's (2001) statistical investigation of the prevalence of civil wars from 1960 to 1999, they find that such greed-related explanations have a greater explanatory power than grievance.

The broad aim of this article is to analyze the roles of greed and grievance in initiating and sustaining the two recent wars in Congo: the rebellion against Mobutu 1996–97 and the great African war that started in 1998. We have chosen to focus on Congo specifically because we believe that any model of appropriative conflict should have something substantial to say about the big war in Central Africa that, in terms of the natural resource rents at stake, the number of casualties, and the number of nations involved, makes most other recent military conflicts pale by comparison. The article starts with a review of the quantitative and qualitative evidence of greed and grievance in the two wars. We argue that while grievances associated with the Tutsi–Hutu conflict in Rwanda that spilled over to Congo in the mid-1990s were important factors for the initiation of both wars, the opportunity to conquer Congo's exceptional natural resource riches appears to have been a primary determinant of conflict intensity, in particular during the war that started in 1998.

By using the framework of appropriative conflict theory, we then outline a game with two groups of players: a ruler and his cronies who control a flow of natural resource rents and a big group of informal subsistence producers who consider starting a predatory uprising against the ruler. The grievance motive that we employ differs from the more general definition in Collier & Hoeffler (2001). In this article, it is modelled as deliberate institutional differences, installed by the ruling group, between formal and informal sector production. Institutional differences are meant to capture aspects like strength of property rights, rule of law, and similar factors affecting production possibilities that are directly under the control of the ruler. More abstract grievances like historical and ethnic rivalries are therefore not included. The greed motive is simply the opportunity for ordinary peasants to conquer the ruling group's natural resource rents. It is shown that while grievance plays a key role for the initiation of a predatory conflict, the intensity of conflict increases linearly with natural resource abundance and with the ruling group's propensity to divert resources for personal enrichment.

In the last analytical section, we use the case study and the model's results to address the question of why a predatory conflict did not break out until 1996, considering Congo's exceptional riches and history of extremely kleptocratic regimes. Our conclusion is that the deterioration in the relative effectiveness of government military forces, in combination with the sudden increase in grievances following the invasion of Hutu refugees after 1994, contributed to the shift to a conflict equilibrium. The enormous quantity of appropriable natural resources then explained the intensity of the great scramble for Congo.

Whereas the interpretation in the literature of the reasons behind the uprising against Mobutu appears to be relatively straightforward, there is less agreement about the motives behind the 1998 war. Our conclusions are largely supported and inspired by the findings in United Nations (2001a,b).

They also conform to the framework of warlord competition in weak African states as spelled out by Reno (1998, 2002). In assessing Uganda's reasons for its renewed military effort in Congo, Clark (2001), on the other hand, downplays and even questions the indications of an economic agenda and argues that it was rather the Ugandan interest in the survival of Rwanda's Tutsi government that fuelled the war.

We believe that the general contribution and novelty of our article compared to the existing literature comes from our use of conflict theory and the greed–grievance taxonomy for discussing the initiation and intensity of the Congolese wars. The predator–prey model that we present follows in the spirit of the appropriative conflict literature (Hirshleifer, 1991; Neary, 1997; Collier, 2000; Skaperdas, 2002; Mehlum, Moene & Torvik, 2003), in particular Grossman (1991, 1999) and Grossman & Kim (1995). As in Olsson (2003), an innovation in our model compared to the earlier literature is the ruler's choice situation between spending available natural resource proceeds on public utilities or on defense of his personal riches, a fraction of which might otherwise be lost to predators. A more specific contribution, unique to this article and in line with empirical observation, is our result that whereas grievances in the form of institutional differences are the key determinant for the initiation of a predatory war, natural resource abundance and the rulers' degree of kleptomania are the primary engines of the subsequent conflict intensity.

The article is organized as follows: the second section reviews Congolese social conflicts from the Rwandan genocide in 1994. The third section presents the theoretical model that is designed to explain some of the mechanisms behind the two wars. On the basis of the model's results, the fourth section analyzes the question of why a predatory conflict did not occur until the late 1990s, given the country's highly appropriable natural resources and kleptocratic regime. The fifth section concludes the article.

Greed and Grievance in Congolese Conflicts

In this section, we briefly recapitulate some key features of conflicts in Congolese history, with an emphasis on developments since the Rwandan genocide in 1994. In particular, the discussion will be structured around the distinction between two major motivations of civil wars: greed and grievance.

Background: 1960–94

Congo gained independence from Belgium in 1960 but immediately fell into a state of chaos and disintegration. In 1965, Colonel Joseph Mobutu seized power through a coup quietly approved by the Western powers, and changed the country's name to Zaire and his own to Mobutu Sese Seko. Zaire became an important pawn in the Cold War as an African bastion of anti-communism. This helped Mobutu to hold his gigantic and ethnically divided country together. When rebel movements threatened to overtake parts of the country in 1964 and in 1977–78, Western powers intervened with military support (Schatzberg, 1997). Even during the last months of Mobutu's reign in 1997, France allegedly organized the hiring of foreign mercenaries in order to avoid the dictator's fall from power (Callaghy, 2001).[2]

In the 1970s, Mobutu and his cronies seriously started to lay their hands on the country's wealth. In a process called 'Zairianization', key economic sectors were put under direct state control (Nzongola-Ntalaja, 2002). Mobutu's kleptocratic regime was coupled with poor growth rates

[2] This behavior might partly be explained by the words of President Mitterand's adviser on African affairs: 'Zaire is the most important Francophone country after France' (Ndikumana & Boyce, 1998: 210).

and a mounting public external debt. International donor pressure and the end of the Cold War finally forced Mobutu to abandon one-party rule in 1990. He also became more marginalized as the government in Kinshasa assumed some of his former powers. But Mobutu would make an unexpected comeback on the world scene.

The Rwanda Genocide and the War Against Mobutu: 1994–97

To understand the insurgency against Mobutu in 1996, it is necessary to recount earlier developments in neighboring Rwanda. Rwanda's two major ethnic groups, the Hutu and the Tutsi, had fought a small-scale civil war since 1990 when an army of Tutsi rebels (RPA), hosted and supported by Uganda, invaded the country. The dramatic turning point happened in 1994 when Rwanda's Hutu president Habyarimana was killed along with Burundi's president after their plane was shot down. Although it is still not clear who was responsible for this attack, extremist Hutu groups drew their own conclusions and soon started a systematic genocide of the civilian Tutsi minority in Rwanda. According to some estimates, around 800,000 people were killed in a few months (Nzongola-Ntalaja, 2002).

The RPA and its leader Major Colonel Paul Kagame managed to conquer Kigali and oust the Hutu government. Fearing Tutsi revenge, around 1.2 million Hutu, including some 40,000 of the militia responsible for the genocide, fled to the North and South Kivu provinces in neighboring Zaire (Emizet, 2000). At this point, Mobutu saw an opportunity to regain the initiative. He agreed to host the refugees on Congolese soil and thereby became a partner to international aid organizations. The move also allowed him to regain some respectability, at least in the eyes of the French, who once again embraced him (Reno, 1998). At the same time, Mobutu used the inflow of Hutu to instigate hostilities towards the Banyamulenge, a people of Tutsi origin who had lived in eastern Congo for generations. The parliament even decided that the Banyamulenge should lose their citizenship. In October 1996, the governor of South Kivu ordered the Banyamulenge to leave their homes within a few days. In desperation, they turned to their Tutsi cousins in Rwanda for help.

The new rulers in Rwanda had an even greater grievance on their hands. The Hutu militia used the refugee camps in Kivu as a base for attacks against the Tutsi-dominated regime in Rwanda. Helped by Mobutu, they became a serious threat to the new government's security. In September 1996, the RPA joined the Banyamulenge and attacked the Hutu refugee camps on Congolese soil. They were soon joined by several anti-Mobutu rebel groups and engaged in battles against government forces.

Among the groups that joined the rebellion was a small one called PRP led by Laurent Kabila. Kabila belonged to Lumumba's socialist faction in the 1960s, but after Mobutu's consolidation of power, Kabila and his men withdrew to the South Kivu mountains where they formed something of a mini-state. Not much is known of his activities from then on, except that during long periods he made a living as a gold smuggler (Schatzberg, 1997). From late 1996 he suddenly appeared as the leader of the newly formed Alliance of the Democratic Forces for the Liberation of Congo (ADFL). It was therefore suspected that Kabila was something of a puppet, at least initially – suspicions that were later confirmed in interviews with Rwanda's strongman Paul Kagame. In Schatzberg's (1997: 80) words: 'From the Rwandan perspective, Kabila was a familiar face who may simply have been in the right place at the right time. Rwanda was the Godfather of the Congolese rebellion.'

The ADFL and their Tutsi comrades

were immediately remarkably successful. Mobutu's unpaid army, which he had kept weak and divided so that it would not pose a threat to himself, melted away as the Tutsi veterans approached. During their march westwards, some 200,000 Hutu refugees were allegedly killed (Emizet, 2000), and conquered mines were looted.[3] The old Cold War allies Belgium and the United States declared that they would no longer come to Mobutu's rescue. Only France, frightened by the prospect of an English-speaking new regime, remained Mobutu's friend to the bitter end. On 17 May 1997, Kinshasa surrendered to Kabila's troops and the old dictator fled the country.

The Great African War: 1998–

Early in his presidency, Kabila showed signs of moving towards one-man rule. His control over state resources was highly personalized, and public enterprises were not managed in any long-term sense of the word but rather used to rapidly generate finances through indiscriminate concession granting (United Nations, 2001b). Corruption, patronage, and lack of accountability came to characterize Kabila's presidency, rather than the hoped for democracy and national development.

Kabila's alliance with Rwanda and Uganda was strong immediately following his rise to power. His government contained many Tutsi (both Rwandan and Congolese) and Banyamulenge in top political and military positions. According to Clark (2001), this placed a strain on Kabila's legitimacy, as most Congolese regarded them as foreign occupiers, which in turn led Kabila to marginalize the Tutsi and Banyamulenge members of his administration. We believe that a more plausible explanation for this action is that Kabila, perhaps inspired by the actions of Mobutu before him, was desirous of keeping the financial gain from Congo's resources for himself. Whatever the explanation, Kabila dismissed a Rwandan military officer of Tutsi ethnicity as chief of staff for the Congolese armed forces in July 1998. He then went one step further, sending the commander and his Tutsi Rwandan comrades-in-arms back to Rwanda on 27 July 1998. This move was an apparent attempt to pre-empt a coup, and was a direct cause of the rebellions that took place in both Goma and Kinshasa six days later (Nzongola-Ntalaja, 2002).

After the failure of these rebellions, troops from Rwanda and Uganda entered Congo in August 1998. Both countries stated security reasons for the deployment (Nzongola-Ntalaja, 2002; Clark, 2001). The crisis escalated when Rwandan troops, with some support from Uganda, attempted to seize Kinshasa. At this point, Zimbabwe and Angola intervened on behalf of the Kabila government, saving it from collapse (Clark, 2001). Namibia, Chad, and Sudan would later join Kabila's allies, although Chad and Sudan withdrew relatively early.

Angola entered the war in Congo primarily for security reasons; UNITA rebels had been using Congo to launch attacks on Angola. Namibia had no immediate security concerns (although it may have feared a spillover into their territory if the conflict in Angola got out of hand), but rather supported Kabila based on a decision by President Nujoma, which was mostly symbolic in nature (United Nations, 2001b). Zimbabwe does not share a border with Congo, and did not face any security threats. The reasons for its involvement seem to be related to investments made in Congo by the government and Zimbabwean businesses (United Nations, 2001b; Nzongola-Ntalaja, 2002).

Economic gain appears to have been a powerful motivator in this war, and there is

[3] Reno (1998) claims that the government-controlled diamond company MIBA had to pay a ransom of $3.5 million to Kabila when his rebels had captured the company's boss in April 1997.

a general consensus that Rwanda's and Uganda's armies quickly began to shift their attention to commercial enterprise and exploitation. The gains from these activities were used to enrich the governments involved, finance the continuation of the war, and pay individual soldiers.

The plunder of Congo's natural resources took place in two phases. The first involved the wholesale looting of existing stockpiles and took place in the occupied regions of Congo during the first year of the second war. The second phase involved systematic extraction and export of natural resources. This phase involved both foreign and Congolese actors. Both phases were greatly facilitated by the strong transportation networks put in place during the first war (United Nations, 2001a).

Economic data collected by the UN illustrate the trends in mineral exports in Uganda and Rwanda for the years 1994 to 2000 (see Table I) and the trends in mineral production in Rwanda for the years 1995 to 2000 (see Table II).[4] The figures in Table I are compromising for several reasons. First, the annual production of gold in Uganda ranged between 0.0015 and 0.0082 tons, while exports over the same period ranged between 0.22 and 11.45 tons. Second, Uganda had no reported coltan or niobium production after 1995, while exports increased steadily between 1997 and 1999. Finally, neither Uganda nor Rwanda has any known diamond production.

The figures in Table II also reveal suspicious trends, notably the surge in gold and coltan production beginning in 1997– the same year Rwandan-backed troops began to take over power in Kinshasa.

Similar figures for Angola, Namibia, and Zimbabwe do not reveal any suspicious trends.[5] In the case of Zimbabwe, however, there is evidence of extensive commercial activity in the form of joint ventures and mining concessions (United Nations, 2001a; Nzongola-Ntalaja, 2002).

Natural resource extraction, particularly mineral extraction, fuelled the continuation of the conflict in Congo. Rwanda's military benefited directly from the war in various ways. The most significant of these has been the extraction of coltan, the price of which rose phenomenally between late 1999 and late 2000. The UN estimates that the Rwandan military could have been selling coltan for as much as $20 million per month. This allowed Rwanda to continue its presence in Congo, protecting individuals and companies who provided minerals. In some cases, the Rwandan army went so far as to attack rebel groups in order to appropriate their coltan supplies. While the Ugandan government was not directly involved in the extraction of natural resources, it did not take action against military and businessmen who participated in this activity (United Nations, 2001a).

Several events have improved the chances of ending the conflict in Congo. The first is Joseph Kabila's rise to power after the assassination of his father in early 2001. The younger Kabila has shown interest in finding a solution to the conflict and reinstating democracy in Congo. Agreements focusing on the transition of the Congolese government towards democracy have been signed, and foreign troops have withdrawn from Congolese soil. However, optimism must be

[4] These two charts help illustrate a fundamental difference in the way Rwanda and Uganda benefited from the extraction of natural resources in the Congo. Rwanda used the economic gains from their activities to fund further military action in the Congo; as President Kagame himself admits, the war in the Congo was self-financing. Uganda, on the other hand, has benefited mainly from the re-export economy, with gold exports greatly improving the balance of payments, and other natural resources generating revenues in the form of taxes and customs duties (United Nations, 2001a).

[5] Although both Angola and Namibia have received some concessions from the Kabila government, these are small and accepted by most experts as compensation for their involvement in the war.

Table I. Mineral Exports, 1994–2000

	Uganda				*Rwanda*
Year	*Gold (tons)*	*Coltan (tons)*	*Niobium (USD, thousands)*	*Diamonds (USD, thousands)*	*Diamonds (USD, thousands)*
1994	0.22	–	–	–	–
1995	3.09	–	0	–	–
1996	5.07	–	0	–	–
1997	6.82	2.57	13	198.3	720.4
1998	5.03	18.57	580	1,440	16.6
1999	11.45	69.5	782	1,813.5	439.3
2000	10.83	–	–	1,263.4*	1,788*

*As of October 2000.
Compiled from United Nations (2001a).

tempered given the persistent fighting between rebel groups in the northeastern part of Congo (United Nations, 2002, 2003a). This has led the UN to adopt Resolution 1493, which authorizes the deployment of UN peacekeepers until 30 July 2004 (United Nations, 2003b).

Congo has experienced two wars in a rather short period of time. Both wars were sparked by grievance (Mobutu's attacks on Tutsi and Banyamulenge in the first war; Kabila marginalizing Tutsi and Banyamulenge, and his neighbors' security concerns, in the second), and involved many of the same actors. Despite these similarities, however, there are important differences. The war against Mobutu was relatively quick and effective, and resulted in his ousting. In contrast, the second war has been long and drawn-out, with sporadic fighting between armed groups. Kabila, unlike Mobutu, was able to hold on to power by virtue of his foreign allies. When his enemies found themselves unable to take control of Congo's resources directly, they turned their efforts to appropriating these resources through looting and extraction. This could be accomplished only by maintaining a military presence in Congo, which in turn prolonged the war.

Table II. Rwanda: Mineral Production, 1995–2000

Year	*Gold (kg)*	*Cassiterite (tons)*	*Coltan (tons)*
1995	1	247	54
1996	1	330	97
1997	10	327	224
1998	17	330	224
1999	10	309	122
2000	10	437	83

Compiled from United Nations (2001a).

The Model

In this section, a general model of appropriative conflict in developing countries is presented that is primarily designed to explain the motives and the scale of the two recent wars on Congolese soil. In particular, our model shows that there is a greed and a grievance motive for potential predators that turn out to play very different roles. The model borrows some of its key features from the economics literature on conflict theory.

Agents

We assume a country or an economically integrated region with two categories of

agents. The first comprises a ruler and his cronies who control a flow of natural resource rents, plus a relatively small group of urban people working in the formal, modern sectors of the economy who are loyal to the ruler. The second category contains the great majority of ordinary peasants or workers who normally engage in subsistence activities but who might also choose to start a predatory aggression. This category might also include people in small neighboring countries who share a similar cultural background and who are disproportionately affected economically by the actions of the ruler.[6] Let us assume that the latter category consists of n individuals. We assume that these diverse groups of people have solved the problem of internal coordination of interests so that they act like a single, rational individual.

These individuals can choose between two activities: peaceful, informal production or more or less violent predation on the ruling group's natural resource rents. Labor is allocated so that $n = l + r$, where l is the number of people in informal production and r is the labor devoted to predation. The group's income from predation is $p\gamma R$. This income forms the 'greed' motive for starting aggressions against the ruler. In the expression, R is the total world market value of the rents from natural resources like copper, cobalt, and diamonds. Out of the total flow, a fraction γ of total resources is diverted by the kleptocratic ruling group as a means of personal enrichment and is available for predation.

Out of the total value γR that can be conquered, the predators manage to lay their hands on a share $p < 1$. This share is given by a typical 'contest success function':[7]

$$p = \frac{r}{r + \theta d} = \frac{1}{1 + \frac{\theta d}{r}} \qquad (1)$$

The variable d measures the resources that the ruler devotes to defending his natural resources riches, while θ reflects the relative strength of defense. The latter parameter is meant to capture both the effectiveness of the domestic forces as well as the strength of foreign alliances with countries that do not fall into the 'potential predator' category.[8] If several countries support the ruler, θ will be large, whereas it will be small if there is external support for the predatory groups.[9] We will discuss this parameter more below. It is easily shown that the predation success function in Equation (1) has the following properties:

$$\frac{\partial p}{\partial r} > 0; \frac{\partial^2 p}{\partial r^2} < 0; \quad \frac{\partial^2 p}{\partial r \partial d} \leq 0 \text{ or } \frac{\partial^2 p}{\partial r \partial d} \geq 0; \frac{\partial p}{\partial \theta} < 0 \qquad (2)$$

In other words, p is a positive, concave function of r so that there are diminishing returns to increasing predatory effort. At low levels of d, the marginal impact of r increases with d, whereas at higher levels, the reverse is true. Finally, an increase in the relative efficiency of defense θ strictly decreases the share that the predators conquer.

The peaceful alternative to predation is informal subsistence production. The production function for this strategy is

[6] In general, we believe that an analysis of civil wars in Africa that fails to consider the influence of actors in neighboring countries is incomplete. For instance, it is impossible to understand the present civil conflict in Liberia without discussing the roles played by supporting groups from Guinea and Ivory Coast. In the case of Congo, we would argue that the second category includes Ugandans and Rwandans (Tutsis) with close economic or ethnic ties to the Congolese.

[7] One might think of p as a probability, so that $p\gamma R$ is the expected income from predation. See Neary (1997) for a discussion of the properties of this class of functions. The particular form below follows Grossman & Kim (1995).

[8] In the Congolese case, Angola, Zimbabwe, Sudan, and Namibia are considered to be such countries. These countries got involved in the conflict only as a response to the aggressions by other parties (United Nations, 2001a).

[9] Grossman (1999) assumes a stochastic θ so that rebels are uncertain about the actual strength of the incumbent ruler.

$$q = A_P l \tag{3}$$

In this expression, q is total output, A_P is a measure of labor productivity in the informal sector, and l is the allocation of labor to production. In line with much of the recent empirical literature on comparative development (Knack & Keefer, 1995; Hall & Jones, 1999), A_P might be thought of as reflecting the level of technology or the quality of institutions prevailing in the informal sectors of the region's economy. It incorporates aspects like the rule of law, strength of private property rights, and protection against random government expropriations. The ruler and his government are the key players in determining the level of A_P. As we shall see, A_P might differ from factor productivity in the formal sectors, A_E, due to intentional discrimination efforts by the ruler. Workers in the informal sector do not pay taxes to the government and thus retain all that they produce.

Individuals in this group receive utility either from production or predation. By combining the equations above, we can form the following utility function for ordinary people:

$$U_P = \frac{\gamma R}{1 + \frac{\theta d}{r}} + A_P\left(n - r\right) \tag{4}$$

The first term on the right-hand side is utility from predation, and the second utility from production. Note that the utility function above is constructed so that the control variable is r, the allocation of labor to predatory activities.

Let us then consider the ruling kleptocratic elite. This group controls a flow of natural resource rents R, which is used for three purposes. We have already mentioned that a fraction γR is used for their own personal enrichment. The remaining part, $(1 - \gamma)R$, is split between defense spendings d and investment in public utilities k. Whereas private wealth γR might be conquered by the predators, the defense and public utility spendings are not natural targets for predation. Defense in this setting should be thought of as a private army of security forces, loyal only to the kleptocrat and whose primary purpose is to defend the ruler's personal riches.

All in all, the ruling group therefore faces the budget restriction:

$$k + d = (1 - \gamma)R \tag{5}$$

We assume that the ruling group gains utility from personal enrichment and total formal sector income according to the function below:

$$U_E = (1 - p)\gamma R + A_E(h + k) \tag{6}$$

The ruling group succeeds in defending a share $(1 - p)$ of their personal riches γR against the predators. Note that if $\gamma = 0$, the utility function above depends only on formal sector income, as in standard growth models.

Total output from the formal sector is $A_E(h + k)$, where A_E is productivity in the formal sector, h is human capital faithful to the ruler that is employed in the formal sector, and k is public utilities provided by the ruler.[10] As was the case with informal sector productivity, A_E reflects the institutional framework created by the ruling elite. In a society with a benevolent ruler, the same basic laws and rights should apply to both sectors so that $A_P = A_E$. However, this is seldom the case in reality. The normal situation is rather that the formal sector is strongly favored, perhaps because it is made up of people belonging to the same ethnic group as the ruler.[11] A_P might fall in a neighboring

[10] For simplicity, h and k are perfect substitutes in formal sector production.

[11] A well-known example is the domination of the Kikuyu tribe in Kenya's post-independence administration and formal sector.

country if the ruler is harboring groups disruptive to the economic conditions in that country. In extreme situations, ordinary subsistence farmers might even be deprived of their citizenship, as happened to the Banyamulenge of eastern Congo in 1996 on Mobutu's initiative. In such a scenario, A_P would be extremely low. Let us therefore define $A_E/A_P = \hat{A} \geq 1$ as a measure of discrimination or of 'institutional grievance', based on deliberately created differences.

By exploiting Equation (1) and the fact that Equation (5) implies $k = (1 - \gamma)R - d$, we can rewrite the expression for welfare as:

$$U_E = \frac{\theta d \gamma R}{r + \theta d} + A_E\left(h + \left(1 - \gamma\right)R - d\right) \quad (7)$$

The noteworthy feature of this welfare expression is that the ruling group's key control variable d enters as a positive influence on $(1 - p)$, i.e. a greater d increases the share that the kleptocrats retain in the appropriative struggle, whereas a greater d also crowds out investments in public utilities and hence decreases tax incomes. There is thus a trade-off to be made between using natural resource rents for productive ends (k) or for securing the elite's wealth (d). This equation completes the description of the basic model.

The Game and Its Solution

The appropriative struggle between the predators and the ruling group assumes the form of a two-stage game where the kleptocrats move first as leaders, taking into account the known response from the potential predators. In the second stage, the predators move and take the ruling group's choice as given. The kleptocrats' choice variable is the level of d, whereas the people choose the optimal level of average predatory activity r.

The game is solved by using backward induction. Hence, we start at the second stage with the people's move. Let us assume that the people are able to coordinate their actions in case of a conflict so that they rise as one opponent against the ruler. They therefore maximize Equation (4) with respect to the choice variable r. The first-order conditions for maximum are:

$$\frac{\gamma R \theta d}{\left(r^* + \theta d\right)^2} - A_P : \leq 0, r^* = 0 \quad (8)$$
$$= 0, r^* > 0$$

The case in the upper row describes a corner solution, where $r^* = 0$ is the optimal choice. In the lower case, however, an interior solution exists. The negative sign in the second-order condition further shows that what we have is a maximum and that U is a concave function of r.

If we have a solution $r^* > 0$, the first-order condition implies that

$$r^* = \sqrt{\frac{\theta d \gamma R}{A_P}} - \theta d \quad (9)$$

This expression defines the predatory alliance's reaction function to the ruling group's defense spendings, d. Differentiation shows that $r'(d) \leq 0$ or $r'(d) \geq 0$, $r''(d) < 0$, and where $r\left(\frac{\gamma R}{\theta A_P}\right) = 0$. Hence, r^* initially increases with d and then decreases until r^* intersects the d-axis, as shown in Figure 1. The area where $r^* > 0$ might be referred to as the 'conflict zone'. At higher levels of d, there will be no predation and no conflict equilibrium.

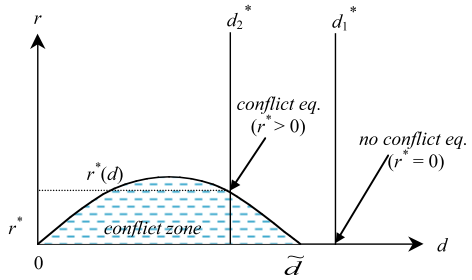
We might restate this finding as a lemma:

Lemma 1: A predatory aggression will occur only if $d < \tilde{d} = \frac{\gamma R}{\theta A_P}$

We will analyze the different possibilities below.

Since the ruling elite has the role of a Stackelberg leader in this game, it takes the people's reaction function as given in its own optimization. By inserting r^* into

Figure 1. Equilibrium Conflict Intensity



Equation (7), we can derive the first-order condition:

$$\frac{\sqrt{\theta\gamma RA_P}}{2\sqrt{d^*}} - A_E = 0 \qquad (10)$$

From here, we can solve for the ruling group's optimal level of defense:

$$d^* = \frac{\theta\gamma RA_P}{4A_E^2} = \frac{\theta\gamma R}{4A_E} \bullet \frac{1}{\hat{A}} \qquad (11)$$

From this simple expression, we receive some clear results:

Proposition 1: The ruling group's optimal defense effort increases with γ, R, θ and A_P and decreases with A_E.

The result that the kleptocratic ruler and his cronies increase defense efforts with the size of their own enrichment, γR, is logical. So is the fact that defense spendings decrease with productivity in the formal sector, A_E. A high A_E means that the opportunity cost of d is high.

Less obvious perhaps is the finding that d^* increases with the quality of defense technology θ. The intuition behind this result is that a high θ means that the marginal returns of an extra million in defense spendings is relatively high. Hence, the prediction is that kleptocratic regimes with a relatively advanced private army will spend more on defense than regimes with an inefficient defense. The result regarding A_P can be explained in a similar manner: a high A_P means that r^* will be small (see Equation 9), which means that the marginal benefit of an extra million in defense spendings is high.

Since the kleptocrats are Stackelberg leaders, the optimal level d^* is also the equilibrium level. By comparing this value with the critical level for conflict in Lemma 1, we obtain the following result:

Proposition 2: A Stackelberg equilibrium with a predatory conflict will exist only if $\theta < 2\hat{A}$.

Proof: From Lemma 1, we know that a predatory conflict, i.e. $r^* > 0$, will break out if $d^* = \frac{\theta\gamma RA_P}{4A_E^2} < \tilde{d} = \frac{\gamma R}{\theta A_P}$. Manipulating this inequality comparison yields the result that $d^* < \tilde{d}$ if $\theta < 2\hat{A}$.

What this result tells us is that a predatory aggression, i.e. an equilibrium inside the conflict zone in Figure 1, will occur if the ruling group's relative strength of defense θ is low and if grievance in terms of institutional differences $\hat{A}$ is high. This simple condition nails down what might be referred to as the 'trigger factors' that determine the timing of a conflict.[12]

The interesting finding is the key role for the grievance term $\hat{A}$. Should institutional differences pass the critical threshold $\theta/2$, predation will become a relevant alternative and a part of the informal labor force n will initiate a conflict.

Equally interesting is what is not included in the proposition: the greed motive γR. As long as $\gamma R > 0$, the size of natural resource rents or the nature of the ruler's enrichment strategy will not matter in the decision whether to start a conflict or not. Natural resource wealth is therefore not a trigger factor. We will discuss this aspect further below.

The second major result in this section concerns conflict intensity, once a predatory

[12] We are grateful to an anonymous referee for suggesting this kind of terminology.

insurrection has been initiated. We define conflict intensity as the total resources devoted to the struggle. The equilibrium overall intensity of appropriative conflict can be calculated to be

$$r^* + d^* = \frac{\theta\gamma R}{4A_E} \cdot \left(2 + \frac{(1-\theta)}{\hat{A}}\right) \quad (12)$$

The implications of this result can be summarized in a proposition:

Proposition 3: The equilibrium level of total conflict intensity $r^* + d^*$ increases with R, γ, and with θ if $\theta < \hat{A} + 0.5$ and with $\hat{A}$ if $\theta > 1$ and decreases with A_E.

In other words, given a conflict equilibrium, high levels of γ and R unambiguously increase the intensity of conflict. Thus, whereas natural resource rents might not be the igniting factor of a conflict, it is a structural factor that increases its intensity. This result appears to be well in line with what has been observed in civil wars in natural resource-rich countries such as Angola, Sudan, and most importantly Congo. This also forms part of an explanation to the curse of natural resources that has been noted by several economists.

Defense technology θ has a concave relationship with conflict intensity. When defense technology is ineffective, an improvement in quality increases conflict intensity, whereas the reverse is true at higher levels of θ. Once again, the relation between θ and $\hat{A}$ is crucial.

Another important result is that conflict intensity increases with $\hat{A}$ if the ruling group has a military strength in the interval $\theta \in (1, 2\hat{A})$. If the ruler has an ineffective defense so that $\theta < 1$, conflict intensity decreases with the level of grievance. What this implies is that if the kleptocrats want to reduce the fighting, they will do so by trying to decrease grievances only if they have a relatively effective defense. A ruler that is very weak militarily will only aggravate the fighting by improving the predators' institutional environment. Hence, the role of grievance is not as clear as the role of greed for understanding conflict intensity.

In summary, the model shows that whereas the grievance motive – defined as institutional differences between the formal and informal sectors – typically is a key factor for explaining the outbreak of violent aggression, the greed motive is a primary determinant for understanding the scale of the conflict.

Analysis

While both the war against Mobutu and the war against Kabila share a number of features, and hence are difficult to distinguish as two completely separate wars, there are a few key differences. In this section we analyze both wars according to the model presented above and explain why the two wars are the same in some respects and differ in other respects.

The first issue that will be addressed in this section is the timing of the two most recent wars in Congo. In a huge and ethnically divided country such as Congo, one would certainly have expected natural resource-driven conflicts to develop. After all, in a neighboring state such as Angola, a civil war with strong elements of appropriative conflict had been going on since the 1980s. So why did Congo not experience the same type of war until the mid-1990s?

We believe that our model provides an answer to this puzzle. Proposition 2 states that a predatory conflict will break out only if $\theta < 2\hat{A}$. As noted above, neither ruler's degree of kleptomania γ nor the value of natural resources rents R thus affect the decision. The intuition is simply that γR is as precious to the ruling group as it is to the predators. If γR increases, the allocation of labor to predation will tend to increase.

However, ruler's defense spending will increase as well, which deters the potential predators. The effects cancel each other out.

Proposition 2 rather suggests that the triggering factors of the two wars were $\hat{A}$, the institutional measure of grievance, and θ, the relative strength of defense. We will address the war against Mobutu first. While institutional quality has long been poor in Congo, it was Mobutu's direct actions against the Banyamulenge, coupled with his lack of action against Hutu militia on Congolese soil, that tipped the balance and widened the gap between A_E and A_P (i.e. increased the size of $\hat{A}$). At the same time, θ was falling. When government forces faltered in the 1977–78 rebellion, Mobutu's 'troika' of Cold War friends (the United States, Belgium, and France) came to the rescue with more or less direct military support. Despite the fact that Mobutu's own army was weak and ineffective, he knew he could count on the military support of his allies, which in turn kept θ artificially high. All that changed with the end of the Cold War. Abandoned by his powerful allies, Mobutu's crumbling army was easily swept aside by Kabila's ADFL in 1996–97.

The war against Kabila was also triggered by institutional grievance. Despite strong relations with Rwanda and Uganda in the beginning of his presidency, Kabila was accused of mismanaging security issues along the Rwandan and Ugandan borders. Kabila then denounced the alliance with the Tutsi and sent them back to Rwanda in July 1998, which could be interpreted as a worsening of the institutional climate for the Tutsi in Congo and thus also for their fellow tribesmen in Rwanda. As a result, A_P fell and $\hat{A}$ became large once again. In addition, θ fell nearly to zero when Kabila's allies became his enemies. Hence, both the war against Mobutu and the war against Kabila were triggered by institutional grievance coupled with weak defense.

The second issue that we would like to raise in this section concerns the scale of the conflict. For many years, Congo managed to stay together and in peace, but by the time the war against Kabila broke out, it involved the whole region. Proposition 3 is the key for understanding this scenario. Whereas the level of γR does not affect the decision to start a conflict, once it had been started, equilibrium conflict intensity increases linearly with γR. We have already discussed the extremely high natural resource rents R that were an important motivation for many of the players.

This raises the question why, given both a large R and a high γ, the war against Mobutu did not evolve into a drawn-out predatory conflict? The evidence in Tables I and II suggest that both Rwanda and Uganda began to exploit Congo's natural resources during the first war, which would lead one to expect a predatory conflict to evolve. The answer lies instead in the value of θ, which fell to zero once Mobutu's weakened forces were defeated. As can be seen from Proposition 3, once θ becomes zero, the entire expression becomes zero. Hence, once Mobutu's forces were defeated, the conflict ended. Further, Rwanda and Uganda had seen to it that a man who (they believed) was loyal to them was put in power. It is quite plausible that Rwanda and Uganda had hoped to take over the role of kleptocratic leaders indirectly, via Kabila.

When Rwanda and Uganda turned on Kabila, initiating the second war, θ once again fell to a level close to zero. It is almost certain that Kabila would have suffered the same fate as his predecessor had Angola and Zimbabwe not intervened. While the support of these allies raised θ significantly, it was not enough to decisively end the war. In other words, the relationship $\theta < 2\hat{A}$ from Proposition 2 still held. Furthermore, Proposition 3 tells us that when $\theta < \hat{A} + 0.5$, an increase in θ increases the equilibrium level

of conflict intensity. Therefore, when Angola and Zimbabwe raised θ, they also increased the intensity of the conflict.

Two other variables that become crucial to conflict intensity are R and γ. As noted above, Congo is a country rich in natural resources, so R has always been large. Many circumstances suggest that when Kabila had completed his conquest of the country, he continued his predecessor's tradition and simply replaced Mobutu with 'Mobutuism' (Callaghy, 2001). Therefore, γ remained high under his rule. These factors combined provided Rwandans and Ugandans with the incentive to prolong the conflict in order to appropriate as many natural resources as possible. Furthermore, the nature of many of these resources made extraction and selling relatively easy. This in turn provided the actors involved with a steady stream of finances, which facilitated the continuation of the war.

Another factor that helps to explain the scale of the conflict is the country's general level of productivity in the formal sector, captured in our model by A_E. Conflict intensity in Proposition 3 decreases linearly with A_E. The parameter might be seen as an indicator of the opportunity cost of conflict on the part of the ruler. So, while the relationship between A_E and A_P (i.e. $\hat{A}$) determines the timing of the war, it is the absolute level of A_E that affects the overall level of conflict intensity. After decades of extortion and mismanagement, Congo's general level of total factor productivity had deteriorated. Hall & Jones (1999) estimate Zaire's total factor productivity (a residual) for 1988 to be 16% of that of the United States and among the lowest in the world. When the same authors measure the quality of institutions, or what they call countries' 'social infrastructure', Zaire gets the lowest score of all 127 countries included in the sample (Hall & Jones, 1999, Figure 2).

The effect of $\hat{A}$ on equilibrium conflict intensity is more complex, because its influence acts in opposite directions in the r^* and d^* functions. When $\theta < 1$, the d^* component of $r^* + d^*$ dominates. As a result, $r^* + d^*$ decreases when $\hat{A}$ increases. When $\theta > 1$, r^* dominates, and conflict intensity increases with $\hat{A}$. It is not possible to know exactly what the situation was in the most recent war in Congo, but it is likely reasonable to assume that θ was relatively low, despite support from allies. Further, $\hat{A}$ could actually be falling, not due to an increase in A_P but rather a fall in A_E. It is therefore difficult to analyze the effect of $\hat{A}$ on conflict intensity in this case.

In summary, grievance coupled with ineffective defense on the part of the ruler pushed Congo into a predatory conflict equilibrium. Once the threshold was passed, the great abundance and value of natural resources, the extent of the ruling group's parasitic inclinations, the poor general quality of social institutions, and the relationship between grievance and the strength of defense all help to explain the dimension of the great scramble for Congo, which is estimated to have taken some 3 million lives.

Concluding Remarks

The purpose of this article has been threefold: to explain the two most recent wars in the Congo in terms of grievance and greed, to present a model that explains the mechanisms behind these two wars, and to answer the question of why a predatory war did not take place in the Congo before 1998.

Based on the quantitative and qualitative evidence presented in the second section, we have concluded that the war against Mobutu was motivated primarily by grievance, interpreted as institutional differences between the ruling group and the people, even if greed likely played a role. The war against the Kabila regime in 1998 was motivated

initially by grievance, but quickly evolved into a predatory war when Kabila was not immediately overthrown.

In the third section, we outlined a model of predatory war based on the framework of appropriative conflict theory created by Grossman (1991) and Hirshleifer (1991). The model takes the form of a Stackelberg game involving two categories of agents: the ruling elite who control the flow of natural resource rents and the majority of ordinary citizens who either engage in subsistence activities or participate in a predatory conflict. We have found that a predatory war will occur if the ruler's defensive strength is low and grievance (conscious differences in institutions) is high. The equilibrium level of overall conflict intensity increases with natural resource abundance, the degree of ruler appropriation, and the general deterioration of institutional quality. The effect of grievance and ruler's defensive strength on overall conflict intensity depends on the somewhat complex relationship between these two variables.

In the fourth section, we address the reasons why, despite the Congo's long history of kleptocratic regimes and its abundance of natural resources, a predatory war did not occur until 1998. We conclude that grievance and relative military strength were deciding factors; Kabila's allies provided him with enough military strength to keep from being overthrown, but not enough to defeat the aggressors. This led to a drawn-out conflict, fuelled by the economic rewards of natural resource predation and worsened by poor institutional quality in the formal sector.

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The Determinants of Rural Child Labor: An Application to India.

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Abstract

There are several factors that may contribute to the decision to send a child to work, such as poverty, market imperfections and parental preferences. The aim of this paper is to determine empirically the relative importance of these diverse factors on the incidence of child labor in rural India. In order to examine several potentially influential factors separately, we outline a theoretical model of child labor in a peasant household based on the model presented in Bhalotra and Heady (2003) with modifications to allow for the child to participate in different types of labor. We then use the theoretical model to specify and estimate an empirical model of rural child labor participation. Our results indicate that parental education and household income appear to play the most important role in determining whether a child works, attends school or is idle. Market imperfections, on the other hand, only play an important role in determining whether the child participates in family labor.

Keywords: child labor, school attendance, market imperfections, India

JEL Codes: J13, J21, I20

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1 Introduction

Why do some households choose to send their children to work rather than school? The answer to this question is not straightforward, as there are several factors that may contribute to this decision. The aim of this paper is to construct a theoretical model that allows for the interplay of several potential determinants of child labor, and to test this model empirically. Identifying the main determinants of child labor is important, as policy prescriptions intended to eliminate child labor will only be effective if they target the root cause of the phenomenon; otherwise, they risk doing more harm than good. Further, if there is not one but rather several factors that contribute significantly to child labor, then several policies may be necessary to address the issue.

In recent years, a growing number of authors have turned their attention to the question of why children work. One line of research seeks to address this question by applying the theory of educational demand put forth by Becker (1991). In this case, the demand for education is based on the optimization of the trade-off between the costs of schooling and the future returns to schooling. If the costs outweigh the benefits, the child will not attend school. Similarly, if the returns to child labor outweigh the costs, the family will send the child to work. Another line of research has focused on the effects of constraints, incentives and agency on the incidence of child labor. The constraint placed on the household by "subsistence poverty" has tended to receive the most attention in the literature (Basu and Van, 1998; Basu, 2000; Bhalotra, 2004), while credit market imperfections constitute another important constraint on the household that may contribute to child labor (Ranjan, 1999; Baland and Robinson, 2000; Dehejia and Gatti, 2002).[1] The role of incentives in child labor has been analyzed in the context of work taking place on the family farm or enterprise. Land and labor market imperfections may result in a higher marginal product of child labor if the household is not able to adjust either its land holdings or the amount of labor employed on the family farm or enterprise, thus increasing the opportunity cost of schooling and providing an incentive to put one's child to work (Bhalotra and Heady, 2003; Dumas, 2004). Finally, agency has been shown to have an effect on the incidence of child labor, as parents may have heterogeneous preferences and unequal intra-household bargaining power and may or may not act altruistically towards

[1] "Subsistence poverty" refers to the case where the household is unable to meet subsistence consumption needs with adult labor income alone, and as such depends on the additional income generated by child labor for survival.

their children (Basu and Ray, 2001; Bhalotra, 2001).

In order to incorporate and examine several potentially influential factors separately, we outline a theoretical model of child labor in a peasant household based on the model presented in Bhalotra and Heady (2003), with modifications to allow for the child to participate in different types of labor. This model is particularly useful when market imperfections are expected to play a role in determining child labor force participation, as well as allowing for the effects parental preferences and household income on child labor. The model predicts that children will be more likely to work in households with low levels of income, and less likely to work in households where the parents exhibit a high preference for schooling. If land/asset and labor markets are imperfect, land and productive assets have a substitution effect that increases the likelihood that children participate in family work. If the credit market is also imperfect, land and productive assets have a credit market effect that make participation in any form of work less likely. Therefore, the predicted effect of land and productive assets on child labor is ambiguous, and depends on the type of work in which the child participates and whether or not market imperfections are present.

Many theoretical models of child labor (most notably the seminal paper by Basu and Van (1998)) assume that both adult and child laborers receive wages from an outside employer and that the labor market functions perfectly (as the results rely upon labor market equilibria and competitive wage setting). This is often not the case. The labor force participation rate of children in rural areas tends to be higher than that in urban areas, resulting in the majority of working children being involved in agricultural work, often on the family farm (ILO, 1996). As a result, models that focus on market wage work will only be relevant to a minority of working children. This is important to keep in mind, as trade sanctions are often mentioned as a means of eliminating child labor in developing countries and bans on child labor in the export sector are unlikely to make much of an impact on the total incidence of child labor. The same is likely to be true of adult minimum wage legislation, which would be of little relevance in the rural areas of most developing countries where self-employment is pervasive (Bhalotra and Tzannatos, 2003). This suggests that a focus on child labor in rural areas may yield important insights into the causes of child labor.[2] As a result, the focus of this paper will be on

[2]Indeed, Andvig (1999) finds a weak relationship between GDP and child labor participation rates in Africa, while the relationship between child labor participation and the percentage of the population in rural areas is significantly positive.

child labor in a rural setting. Further, in contrast to several previous studies, the model presented in this paper allows for an analysis of both family and non-family labor.

The main predictions of the theoretical model are analyzed empirically for children aged 7-14 using data drawn from the Human Development Profile for India, collected by the National Council of Applied Economic Research (NCAER) in 1994. This is a household survey that is representative of the rural population for all of India.[3] Children are classified by activity based on their main occupation, i.e. the activity they take part in for at least half the year. While this is a very strict definition that potentially underestimates the scope of child labor, it is also useful in many respects. One advantage is that the children classified as working become a much more homogeneous group. It may not be the case that children working a few hours a month are affected by the same factors as children who have work as their main occupation. Further, it is not obvious that all child labor is harmful or undesirable; working on the family farm or enterprise under parental supervision for a few hours a week, for example, may be considered beneficial to the child in terms of socialization and skill acquisition. Child labor can be considered harmful, however, in the case of children whose main occupation is work insofar as working significantly hinders, and in many cases prevents, these children from receiving an education.[4]

The results of the empirical analysis indicate that household income and parental education are significant determinants of child labor. Further, market imperfections contribute significantly to child labor, particularly in the case of family work. Therefore, policies aimed at raising household income may be successful in reducing child labor and increasing school attendance in the short-run, while policies aimed at improving access to and the quality of schooling may be more successful in the long-run.

The remainder of the paper is organized a follows. Section two outlines a theoretical model of child labor. Descriptive statistics of child labor in rural India by gender and land ownership are given in Section three. Section four presents the empirical specification and discusses some estimation issues, the

[3] While the rate of participation in child labor in India may not be particularly high, especially compared to sub-Saharan African countries, the absolute number of children participating in some form of labor is substantial due to India's large population.

[4] Child labor may be harmful in several other respects, especially when working conditions are hazardous or children are mistreated by their employers. However, as the survey does not contain information on the conditions under which children work, the only form of harm that can be demonstrated is the deprivation of educational opportunities.

results of which are discussed in Section five. Section six concludes the paper.

2 The theoretical model

The theoretical model developed in this section is taken from Bhalotra and Heady (2003) with some modifications. In keeping with Bhalotra and Heady, we specify a two period model of a peasant household, and for simplicity we assume that each household contains one parent and one child. We maintain the assumption that the parent always works, and that the child does not bargain with its parent, i.e. the parent decides how the child's time is allocated.[5] While Bhalotra and Heady assume that households do not hire out labor, we assume that households may hire out child labor. The parent produces output in each period using their own labor, owned and rented land, owned productive assets, hired labor and potentially their child's labor as inputs. Children who do not participate in family work in the first period may work as wage laborers outside the family or they may attend school, but we assume that they do not combine any of these activities. It is also possible that the child participates in none of these activities in the first period, in which case the child is idle.

The first period household production function is given by:

$$f\left(A_o, A_{r1}, K_o, L_{p1}, L_{cf1}, L_{h1}\right) \tag{1}$$

where A_o and A_r are owned and rented land, K_o is owned productive capital, L_p and L_h are parent and hired labor and L_{cf} is child family labor ($= 0$ if the child does not participate in family work). Hired labor is not a perfect substitute for family labor when the labor market is imperfect, just as rented land is not a perfect substitute for owned land when the market for land is imperfect. Further, we assume that child labor is not a perfect substitute for adult labor.[6] Therefore, each type of land and labor used to produce output enters the production function as a distinct input. We assume that there are decreasing marginal returns to all inputs, so that the first derivative of the production function with respect to any of the inputs is positive, while the

[5] See Basu (1999) for an overview of models of child labor with intra-household bargaining. The assumption that children do not bargain with their parents is quite reasonable, as the only recourse a young child would have is to leave the household, which is not likely an attractive alternative. Bhalotra and Heady point out that this option becomes even less attractive for children who can expect to inherit the family farm.

[6] This is a common assumption in the literature; see Basu and Van (1998), Ranjan (2001), for example.

second derivative is negative. Finally, we assume that total land, total labor and capital enter the production function multiplicatively.

In the case where the child participates in family work, first period net household income, Y_1, is a function of the household production function as follows:

$$Y_1 = f\left(A_o, A_{r1}, K_o, L_{p1}, L_{cf1}, L_{h1}\right) - w_{h1}L_{h1} - p_{r1}A_{r1} \tag{2a}$$

whereas in the case where the child works as a wage laborer, net household income in the first period is given by:

$$Y_1 = f\left(A_o, A_{r1}, K_o, L_{p1}, L_{h1}\right) + w_{cw1}L_{cw1} - w_{h1}L_{h1} - p_{r1}A_{r1} \tag{2b}$$

and in the case where the child attends school or is idle, net household income in the first period is given by:

$$Y_1 = f\left(A_o, A_{r1}, K_o, L_{p1}, L_{h1}\right) - w_{h1}L_{h1} - p_{r1}A_{r1}. \tag{2c}$$

In the above equations, w_{cw} and w_h are wages paid to child and hired labor and p_r is the price of rented land.

In the second period the child has become an adult and may or may not continue to live in the family household, but it is assumed that their income and consumption remain part of the household total. Therefore, the child's contribution to household income in the second period enters the income equation separate from the household production function (which maintains the same characteristics as in the first period in all other respects). Second period household income is given by:

$$Y_2 = f\left(A_o, A_{r2}, K_o, L_{p2}, L_{h2}\right) + w_{c2}\left(ACT_1\right)L_{c2} - w_{h2}L_{h2} - p_{r2}A_{r2} \tag{3}$$

where $ACT_1 = L_{cf1}, L_{cw1}, S, I$ depending on whether the child worked, attended school or was idle in the first period. Further, w_{c2} is not necessarily an explicit wage; it may be the marginal product of the child's own farm labor, for example. Thus we assume that the child's second period wage is a function of the first period activity in which the child participated. This allows for a dynamic effect for the choice of activity in the first period.

We assume that the household can either save or borrow in the first period, so that first period consumption is not bound by first period income. Further,

the household is assumed to inherit some initial financial wealth (which can be either positive or negative) from period zero. First period net financial wealth, ω_1, is thus given by:

$$\omega_1 = \omega_0 + Y_1 - X_1 - C(S) \tag{4}$$

where ω_0 is initial financial wealth, $C(S)$ is the direct cost of schooling ($= 0$ if the child does not attend school) and X_1 is first period consumption (the price of which is normalized to unity).

When the credit market is imperfect the interest rate, r, available to the household becomes a function of wealth. Hence, second period financial wealth is a function of both first period wealth and the interest rate. If $\omega_1 < 0$, i.e. if the household is in debt and requires a loan, then the interest rate will also depend on the personal characteristics of the loan-taker, Z, as well as the amount collateral the household can supply. In the case of rural households, collateral will most likely take the form of owned land, A_o, making the interest rate a function of A_o, Z and ω_1 when the household takes a loan.[7] Consequently, second period net financial wealth is given by:

$$\omega_2 = Y_2 - X_2 + \omega_1 (1 + r(\omega_1)) \tag{5a}$$

when $\omega_1 > 0$, and by:

$$\omega_2 = Y_2 - X_2 + \omega_1 (1 + r(\omega_1, A_o; Z)) \tag{5b}$$

when $\omega_1 < 0$. Simplifying this expression somewhat, we can express the corresponding second period budget constraint as:

$$X_2 = Y_2 + \omega_1 (g(\omega_1)) \tag{6a}$$

when the household saves in the first period, and as:

$$X_2 = Y_2 + \omega_1 (g(\omega_1, A_o; Z)) \tag{6b}$$

when the household borrows in the first period. We will assume that $\left(\frac{\partial g}{\partial \omega_1}\right) >$

[7] Swain (2001) provides evidence of the important role of land ownership in credit markets in the Puri district of Orissa in India. She finds that the amount of land owned is positively related to access to loans. Further, when a loan is granted the amount of land owned has a significant influence on the rate of interest paid.

0 and $\left(\frac{\partial^2 g}{\partial \omega_1^2}\right) < 0$ when the household saves and that $\left(\frac{\partial g}{\partial \omega_1}\right) < 0$, $\left(\frac{\partial^2 g}{\partial \omega_1^2}\right) > 0$, $\left(\frac{\partial g}{\partial A_o}\right) < 0$ and $\left(\frac{\partial^2 g}{\partial A_o^2}\right) > 0$ when the household borrows.

The household now endeavors to maximize its utility function, which is assumed to be time separable and is given by:

$$U = U_1\left(X_1, L_{p1}, ACT_1\right) + \delta U_2\left(X_2, L_{p2}, L_{c2}\right) \tag{7}$$

where $\delta \leq 1$ is the inverse of the time discount factor, ρ, (i.e. $\delta = \frac{1}{\rho}$) and ACT_1 is as defined above. The utility function is assumed to be a twice differentiable positive concave function of consumption and leisure, so that the marginal utility of consumption is positive while the marginal utility of labor and schooling is negative (i.e. the marginal utility of leisure is positive). Thus, the parent is faced with the following maximization problem:

$$\begin{aligned} \max\ U \qquad & \text{subject to } \omega_1 - \omega_0 - Y_1 + X_1 + C\left(S\right) = 0 \text{ and} \\ & X_2 - f\left(A_o, A_{r2}, K_o, L_{p2}, L_{h2}\right) - w_{c2}\left(ACT_1\right) L_{c2} \\ & + w_{h2} L_{h2} + p_{r2} A_{r2} - \omega_1 g\left(\omega_1, A_o; Z\right) = 0 \end{aligned} \tag{8}$$

where Y_1 is given by (2a), (2b) or (2c) above.

By setting up a Lagrangian function Γ with multipliers λ_1 and λ_2, we can derive the first order conditions relevant to the child labor/schooling decision:

$$\frac{\partial \Gamma}{\partial X_1} = \left(\frac{\partial U_1}{\partial X_1}\right) - \lambda_1 = 0 \tag{9}$$

$$\frac{\partial \Gamma}{\partial X_2} = \delta\left(\frac{\partial U_2}{\partial X_2}\right) - \lambda_2 = 0 \tag{10}$$

$$\frac{\partial \Gamma}{\partial \omega_1} = \left(\omega_1\left(\frac{\partial g}{\partial \omega_1}\right) + g\left(\omega_1\right)\right)\lambda_2 - \lambda_1 = 0 \tag{11a}$$

if the household saves in the first period, or

$$\frac{\partial \Gamma}{\partial \omega_1} = \left(\omega_1\left(\frac{\partial g}{\partial \omega_1}\right) + g\left(\omega_1, A_o; Z\right)\right)\lambda_2 - \lambda_1 = 0 \tag{11b}$$

if the household borrows in the first period.

$$\frac{\partial \Gamma}{\partial L_{cf1}} = \left(\frac{\partial U_1}{\partial L_{cf1}}\right) + \left(\frac{\partial f}{\partial L_{cf1}}\right)\lambda_1 + L_{c2}\left(\frac{\partial w_{c2}}{\partial L_{cf1}}\right)\lambda_2 \leq 0 \tag{12}$$

$$\frac{\partial \Gamma}{\partial L_{cw1}} = \left(\frac{\partial U_1}{\partial L_{cw1}}\right) + w_{cw1}\lambda_1 + L_{c2}\left(\frac{\partial w_{c2}}{\partial L_{cw1}}\right)\lambda_2 \leq 0 \tag{13}$$

$$\frac{\partial \Gamma}{\partial S} = \left(\frac{\partial U_1}{\partial S}\right) - \left(\frac{\partial C}{\partial S}\right)\lambda_1 + L_{c2}\left(\frac{\partial w_{c2}}{\partial S}\right)\lambda_2 \leq 0. \tag{14}$$

Equation (12) tells us that the child will participate in family labor if the value of the marginal product of first period family labor plus the value of the increase in the second period wage due to family work experience is equal to the marginal disutility of family labor. The decision to send the child to participate in wage labor hinges on (13), which states that the child will participate in wage labor if the first period wage plus the value of the increase in the second period wage due to wage work experience is equal to the marginal disutility of wage labor. Finally, (14) gives the condition necessary for a parent to send their child to school and states that the value of the increase in the second period wage due to schooling minus the marginal cost of schooling must be equal to the marginal disutility of schooling. These results can be summarized in the following Lemma:

Lemma 1 *The maximization problem in (8) has four potentially unique solutions for child activity:*

$$ACT_1: \begin{cases} = L_{cf1} & \textit{if (12) holds with equality} \quad \textit{and (13), (14) hold with strict inequality.} \quad \textit{(i)} \\ = L_{cw1} & \textit{if (13) holds with equality} \quad \textit{and (12), (14) hold with strict inequality.} \quad \textit{(ii)} \\ = S & \textit{if (14) holds with equality} \quad \textit{and (12), (13) hold with strict inequality.} \quad \textit{(iii)} \\ = I & \textit{if (12), (13) and (14) all hold with strict inequality.} \quad \textit{(iv)} \end{cases}$$

where

$$\lambda_1 = \left(\frac{\partial U_1}{\partial X_1}\right) = W\delta\left(\frac{\partial U_2}{\partial X_2}\right) \tag{15}$$

and

$$\lambda_2 = \delta\left(\frac{\partial U_2}{\partial X_2}\right) \tag{16}$$

with $W = \left(\omega_1\left(\frac{\partial g}{\partial \omega_1}\right) + g(\omega_1)\right)$ *when the household saves in the first period and* $W = \left(\omega_1\left(\frac{\partial g}{\partial \omega_1}\right) + g(\omega_1, A_o; Z)\right)$ *when the household borrows in the first period.*

If more than one of the equations (12), (13) and (14) hold with equality, then the parent will be indifferent between the respective activities and we are unable to predict which activity will be chosen.

Proof. These results follow directly from the first order conditions pre-

sented above. ■

From the results in Lemma 1, we can derive the following propositions:

Proposition 1 *Land and productive assets have a substitution effect on the child's participation in family work, making participation in family work more likely as the household's land and productive asset holdings increase.*

Proof. From (12), it is clear that the child will be more likely to participate in family labor as $\frac{\partial f}{\partial L_{cf1}}$ increases. It follows from (1) and our assumptions that land and assets enter the production function multiplicatively and that the production function is positive and concave that as the household's holding of land and productive assets increase, the marginal productivity of child family labor increases, holding all else constant. This in turn increases the incentive to employ the child in family work. ■

Proposition 2 *Land has an income effect that decreases the likelihood that the child participates in any form of work and increases the likelihood that the child attends school as land holdings increase.*

Proof. See Appendix 1. ■

Proposition 3 *When the credit market is imperfect and the household borrows, there is a credit market effect of holding land that makes the child less likely to participate in any form of work and more likely to attend school as land holdings increase.*

Proof. See Appendix 1. ■

Proposition 4 *When the credit market is imperfect and the household saves, there is a credit market effect of holding land that makes the child less likely to participate in any form of work and more likely to attend school as land holdings increase, when first period wealth is sufficiently large. This effect is smaller, however, than in the case when the household borrows, and may even be reversed if first period wealth is small.*

Proof. See Appendix 1. ■

Propositions 1 to 4 demonstrate the different effects land and productive asset holdings can have on participation in child labor. Proposition 1 illustrates the substitution effect of land and productive assets on child family work, which is the incentive aspect of the model. The substitution effect

arises from land and labor market imperfections, i.e. the household is unable to adjust its land holdings and the number of workers outside the family it employs. The result is that as the household's holding of land and productive assets increase, the marginal productivity of child family labor increases, and the incentive to employ the child in family work becomes greater. The substitution effect is only relevant for family work, as an increase in land and productive asset holdings will not affect the wage received when the child participates in wage labor and will not have a direct impact on the decision whether or not to send the child to school.

Proposition 2 illustrates the income effect of land on child labor. While this is related to the poverty constraint that is present in other theoretical models, the income effect here cannot be seen as compelling poverty. The effect of land and productive assets in this case is indirect, and works through the production function. Households with larger land and productive asset holdings will produce more output in both periods, and will hence have a higher net income from which they can consume. This is turn will increase the likelihood that the parent will be able to forgo the extra income that could be earned by the child through either family or wage labor. Therefore, we would expect an income effect from holding land and productive assets that would act to lower the incidence of child labor. In the case of family labor, the wealth effect may be partially or even wholly offset by the substitution effect of land and productive assets, which acts to increase the incidence of child family labor.

Propositions 3 and 4 illustrate the credit effect of holding land. When the credit market is imperfect, the interest rate paid on loans is a negative function of first period wealth and the amount of land held by the household. First period wealth, in turn, is a positive function of land holdings. Therefore, as land holdings increase, the rate of interest the household has to pay on its loan decreases, and it becomes more likely that the household can forgo the income that the child could earn through participating in some form of labor. The result is that land holdings are expected to be negatively related to child labor. When the household saves, the interest rate paid on savings is a positive function of first period wealth. Therefore, while land holdings are generally expected to lower the incidence of child labor, there is an incentive to increase first period wealth, and hence increase the interest rate earned in the first period. If this incentive is sufficiently large, the household may actually have an incentive to send the child to work. We believe, however,

that this scenario is improbable. Therefore, credit market imperfections are expected to lead to a negative relationship between land holdings and child labor.

While propositions 2 to 4 have only explicitly considered the effects of land holdings on the child's participation in work and school attendance, it is straightforward to confirm that the results hold for productive asset holdings as well. In this case, we would include the additional assumption that the effect of asset ownership on the interest rate is identical to the effect of land on the interest rate in the case where the household requires a loan.

Controlling for the income effect of land and productive asset holdings, there are two opposing effects of land and asset holdings on child participation in family work: the substitution effect and the credit market effect. If land and assets have a positive effect on child family labor, then we can assume that the land and labor markets are imperfect, while we cannot say anything about the credit market. If the effect of land and assets on child family labor is zero, then either all markets are perfect, or the effect of the land and labor market imperfections is exactly offset by the effect of the credit market imperfection. Finally, if land and assets have a negative effect on the child's participation in family work, then we can conclude that the credit market is imperfect. Similarly, if the effect of land and assets on child non-family work is zero, then we can assume that the credit market is perfect, while a negative effect of land and assets indicates that the credit market is imperfect.

Proposition 5 *Children will be more likely to participate in some form of work if their parents exhibit a greater preference for child labor (i.e. if they experience a smaller disutility of sending the child to work). Conversely, children will be more likely to attend school if their parents exhibit a greater preference for schooling (i.e. if they experience a smaller disutility of sending the child to school).*

Proof. From (12), (13) and (14) above, it is clear that these equations are more likely to hold with equality as $\left(\frac{\partial U_1}{\partial L_{cf1}}\right)$, $\left(\frac{\partial U_1}{\partial L_{cw1}}\right)$ and $\left(\frac{\partial U_1}{\partial S}\right)$ become less negative. ■

Proposition 5 demonstrates the role of parental preferences in the choice of activity in which the child will participate, and represents the agency aspect of the model. Parental preferences will affect the relative marginal disutility of child family labor, child wage labor and schooling. One could easily imagine that wage labor would yield the highest level of disutility, followed by family

labor and schooling. If parents do not value schooling at all, however, then one would expect that schooling would yield a relatively high level of marginal disutility. Similarly, some parents may exhibit a small distaste for child labor if they believe that child labor has some beneficial effects on the child in terms of socialization and experience (that does not necessarily translate directly into higher future wages). Additionally, the degree of parental altruism will affect the preferences for schooling versus child labor.

The cost of schooling will have an effect on whether or not the child attends school, as can be seen from (14). Parents may choose not to send their children to school if the marginal cost of school attendance (i.e. $\left(\frac{\partial C(S)}{\partial S}\right)$) is high. This will be the case even when the parent does not have the incentive to send the child to work (in which case the child will be idle in the first period). Further, as the benefits of sending the child to school do not materialize until the second period (as the child does not generate any income in the first period), parents who have a high discount rate (i.e. small δ) will not be adequately compensated for the marginal cost and disutility of schooling and as such will choose not to send their children to school.

From (12), (13) and (14) it is apparent that the effect of first period child activity on second period wages will play an important role in determining the activity in which the child will participate. The effect of child labor/schooling on future wages will depend on a number of factors. For example, if the child is expected to inherit the family farm, the return to child family labor may be much higher than the return to wage labor or even schooling. While empirical evidence has shown that the returns to schooling are generally quite high on an aggregate (national) level, the quality of local schools may be such that the benefit in terms of increased future wages is negligible or even zero.[8] Even if the schools are of high quality, low demand for high skilled labor will result in schooling having a small impact on second period wages. The same will hold true if the child belongs to a group that is economically discriminated against (for example women or members of minority groups), resulting in a limited number of job opportunities for the child in the second period. Finally, while we have not distinguished between boys and girls in the theoretical model, the assumption that the child pools its second period income with the household may be less likely to hold in the case of girls, further weakening the incentive to send girls to school.

[8] For example, Psacharopoulos (1994) provides macroeconomic evidence that shows that the returns to education are higher than the returns to physical capital in all parts of the world, indicating that education should be profitable in many cases.

3 Data and descriptive statistics

The data used in this paper are drawn from the Human Development Profile for India, collected by the National Council of Applied Economic Research (NCAER) in 1994. The sample is representative of the rural population at the level of all India, and includes 33,229 households spread over 1,765 villages in 16 states. A child is defined in the survey as a person under the age of 15. For the purposes of this study, we will focus on children ages 7-14, in keeping with the definition of a child commonly used by the International Labor Organization (ILO, 2002), for example.[9] Further, the survey follows the definition of work as set out by the ILO. Children are considered economically active if they participate in market production and paid work or if they participate in certain unpaid non-market production, such as production of goods for own use or work on a family operated enterprise. As such, economic activity is not confined to the formal sector, but rather encompasses the informal sector and illegal activities as well. Children who perform domestic chores in their own household, however, are not considered to be economically active and are therefore not considered to be engaged in child labor.

We have data on the primary and secondary occupational status of the children in the sample. The primary occupation of the child is defined as the activity that the child is engaged in for at least half the year, while the secondary occupation of the child is any activity that the child participates in additional to the primary occupation (Shariff, 1999). Classifying the children according to activity is relatively straightforward. However, in the case where the primary occupation of the child is not stated, or given as "child under 15 years", we assign the child to the category stated as their secondary occupation. If no secondary occupation is given, the child is considered idle.

Classifying the children based on their primary occupation is a very restrictive measure of child labor and, to a somewhat lesser extent, school attendance. One striking feature of the data is that only about 0.5% of the children sampled report that they combine school and work of one form or another. The reason for this is that there are very few children who report both a primary occupation and a secondary occupation. As a result, the analysis will be focused on children's participation in the activity that they are engaged in for at least half of the year. This is a very strict definition of

[9] The ILO tends to focus on children between the ages of 5-14. We limit our analysis to children 7-14, however, due to the fact that almost all children ages 5-6 are idle, with the second largest group attending school. It is reasonable to assume that in most cases, five and six year old children are too young for any activity other than idleness.

child labor/school attendance that carries with it both advantages and disadvantages. The obvious disadvantage is that children who only work for part of the year and attend school or are idle for the rest of the year are not included as child laborers. It is reasonable to expect that this category of child laborers is quite substantial. The advantage, however, is that the categories we analyze are considerably more homogeneous than would otherwise be the case (the exception to this case being idle children). Indeed, one could reasonably expect significant difference between children who work at least half of the year and children who work a few hours a week. This is not to say that the latter group is not of interest; however, children in the former group share the characteristic that they are engaging in work to the extent that it significantly hinders, and in many cases prevents, them from receiving an education. Further, a number of previous studies have measured child labor based on the number of hours the child worked in the week previous to the survey (see Bhalotra (2004), Dehejia and Gatti (2002) and ILO (1996), for example) These results may be sensitive to the time of the year that the survey is carried out. Our data, on the other hand, uses an annual measure of child labor.

We can divide children's occupational status into four categories: student, family worker, non-family worker, and idle. Family work includes all productive work done within the household, while non-family work refers to economic activities that the child takes part in outside of the household, such as wage labor. A problem arises in how we treat a fifth category of children, namely those who list their primary occupation as "own household work", which is defined as unpaid household work that does not contribute to household income. As mentioned above, the ILO does not consider household chores and similar non-productive activities to be work. As such, one alternative is to include these children in the category of idle children, as they are not economically active. However, these children may be contributing to household income indirectly; by carrying out domestic chores, they may allow another member of the household (the mother, for example) to participate in productive work. Further, if the child had been carrying out the same duties in another household, they would qualify as a domestic servant and would be considered economically active. Therefore, we choose to assign these children to their own category, as domestic workers.

Tables 1 and 2 contain correlation coefficients for some variables of interest. Table 1 present the correlation coefficients for household size and

Table 1: Correlation coefficients for household size and composition, land, assets and income, pooled sample.

	Household size	Land	Prod. assets	ln(hh income)	ln(pc income)	Average age	Prop. children in hh
Household size	1.0000						
Land in acres	0.2358	1.0000					
Index of productive assets	0.3033	0.2307	1.0000				
ln(household income)	0.3993	0.3291	0.3878	1.0000			
ln(per capita income)	-0.0298	0.2559	0.2857	0.8949	1.0000		
Average age of household members	-0.0224	0.0591	0.0861	0.1385	0.1740	1.0000	
Proportion of children in household	0.2642	0.0034¤	0.0086¤	-0.0273	-0.2000	-0.7020	1.0000

Note: The superscript ¤ indicates that the correlation coefficient is not significantly different from zero.

Table 2: Correlation coefficients for parental education and household size and composition, pooled sample.

	Father illiterate	Mother illiterate	Father prim. ed.	Mother prim. ed.	Father mid. ed.	Father sec. ed.	Mother mid./sec. ed.	Household size	Prop. children in hh
Father illiterate	1.0000								
Mother illiterate	0.4077	1.0000							
Father primary ed.		-0.0289	1.0000						
Mother primary ed.	-0.2839		0.1471	1.0000					
Father middle ed.		-0.1336		0.1367	1.0000				
Father secondary ed.		-0.3058		0.0773		1.0000			
Mother middle/secondary ed.	-0.2478		-0.1079		0.0640	0.4119	1.0000		
Household size	-0.0596	-0.0009¤	-0.0016¤	0.0132	0.0356	0.0830	0.0085¤	1.0000	
Proportion of children in the household	0.0630	0.1098	-0.0007¤	-0.0279	-0.0087	-0.0363	-0.0879	0.2642	1.0000

Note: The superscript ¤ indicates that the correlation coefficient is not significantly different from zero.

composition, land, income and assets for the pooled sample. Household size is strongly positively correlated to land and productive asset holdings, total household income and the proportion of children in the household, while it is negatively correlated with the average age of the household members and per capita income, where the latter is simply total household income divided by household size. Further, while the proportion of children in the household is negatively correlated with both total household income and per capita income, the coefficient is significantly greater in the latter case.

Table 2 present the correlation coefficients for parental education and household size and composition for the pooled sample. The correlation coefficients between mothers' and fathers' education seems to indicate that parents often have similar educational levels. Higher levels of parental education is negatively correlated with the proportion of children in the household and positively correlated with household size.

3.1 Activity rates

In Table 3 we present the percentage of children participating in each activity by gender and land ownership, household income and parental education, and give the average age of children by gender and occupation. Perhaps not surprisingly, school attendance is higher among children from households that own land than children from those that do not. When looking at child labor, we see that more boys are engaged in family work in the land owning households than in the households that do not own land. The opposite is true of the relationship between land ownership and family labor for the girls in the sample. The percentage of children who are idle and the percentage of children who participate in non-family and domestic work are lower in households that own land, regardless of gender. Finally, the percentage of children who attend school is higher in households that own land, again regardless of gender. Therefore, when comparing land owning households with landless households, it appears as if the wealth paradox is only relevant for boys.

Focusing solely on the differences between households that own land and that do not own land may obscure important differences within the group of land owning households that vary with respect to the size of land holdings. Examining the data by farm size reveals variation in all participation rates. The wealth paradox becomes apparent for both girls and boys in family work; for girls there is a positive linear relationship between farm size and participation in family work, while for boys the relationship appears to be nonlinear.

Table 3: Participation rates (%) of children 7 – 14 in primary occupation categories by land owned, household income and parental education.

	Primary Occupation Category									
	School		*Family work*		*Non-family work*		*Domestic work*		*Idle*	
Land ownership by household:	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Does not own land	70.27	57.46	0.94	2.83	5.89	5.45	1.61	9.29	21.29	24.97
Owns land	78.10	63.89	2.01	2.52	2.47	1.83	1.19	7.95	16.22	23.81
Acres of land (> 0):										
Up to 15 acres	75.45	62.24	1.51	2.34	3.70	2.21	1.43	8.29	17.91	24.91
15 – 30 acres	77.11	61.92	2.35	2.57	2.38	2.44	1.22	8.34	16.93	24.73
30 – 60 acres	78.70	63.71	2.08	2.50	2.21	1.89	1.01	8.18	16.01	23.71
Over 60 acres	81.67	68.16	2.16	2.70	1.41	0.66	1.08	6.89	13.69	21.59
Household income:										
Up to 10,000 INR	67.63	50.55	1.74	4.07	4.81	3.98	1.82	9.92	24.00	31.48
10,001 – 20,000 INR	71.19	55.79	1.62	2.48	4.53	3.95	1.65	9.82	21.01	27.96
20,001 – 30,000 INR	77.26	62.90	1.77	2.78	3.63	3.07	1.01	8.52	16.33	22.73
Over 30,000 INR	84.62	75.13	1.62	1.70	1.65	1.26	0.84	5.74	11.28	16.16
Father's education:										
Illiterate	59.87	41.21	2.44	3.72	5.59	4.73	2.10	11.86	30.00	38.49
Primary	84.11	69.49	1.50	2.49	2.78	2.65	1.05	7.17	10.56	18.20
Middle	89.24	78.31	0.74	1.52	1.06	0.60	0.29	4.57	8.67	15.00
Secondary	93.75	88.86	0.27	0.38	0.43	0.49	0.47	2.69	5.09	7.58
Mother's education:										
Illiterate	69.66	52.25	1.99	3.06	4.28	3.70	1.58	9.88	22.50	31.11
Primary	93.95	88.62	0.94	1.38	1.34	1.17	0.44	3.11	3.33	5.73
Middle/ Secondary	96.21	95.59	0.06	0.26	0.35	0.13	0.35	0.91	3.03	3.11
Average age of the child (in years):	10.37	10.22	12.36	11.86	12.36	12.12	11.60	12.10	9.93	9.72

Note: INR = Indian rupee.

Girls' school attendance exhibits a nonlinear relationship with farm size, while boys' school attendance exhibits a linear positive relationship with farm size. Participation in non-family labor declines linearly with farm size for boys, while it exhibits a nonlinear relationship for girls. Finally, the percentage of children who are idle varies negatively and linearly with farm size.

School participation for both boys and girls increases with household income, while participation in all other activities except family work decreases with household income. The non-linear relationship between household income and family work for both boys and girls may depend on the relationship between land holdings and household income. Finally, an increase in parental education has the effect of increasing school participation and decreasing participation in all other activities for both boys and girls.

Idle children are younger, on average, than children participating in any activity while working children are older on average than children attending school.

3.2 School attendance in India

Article 45 of India's constitution calls for the State to provide free and compulsory schooling for all children up to age 14. This article falls within the Directive Principles of the constitution, however, and as such is not formal law (Sripati and Thiruvengadam, 2004). Therefore, free schooling is not always provided, and compulsory attendance is not always enforced; both accessibility and enforcement varies from state to state.

Children typically begin primary school at age 6 and are considered to have primary education after completing classes one through five. Classes six through eight are taught in middle schools and are generally attended by children aged 11-14, while secondary school pupils are typically between ages 14 and 17 and attend classes nine through twelve. Thus, all of the children in our sample are old enough to have begun attending primary school.

4 The empirical model

From the theoretical model in section 2 above, the participation equations for farm work, wage work, idleness and schooling can be expressed as:

$$ACT_{c1} = g\left(A_o, \omega_0, w_{h1}, w_{h2}, p_{r1}, p_{r2}, C(S); Z, e\right) \tag{17}$$

where ACT_{c1} is the child's activity in period one and e represents optimization errors and other unobservable variables of influence. An immediate problem

with the above equation is that ω_0 is unobservable. However, ω_0 can be written as a function of Y_1, and as Y_1 is observable it can be substituted for ω_0 in (17).[10] Further, we do not have information on the wages paid to hired labor (w_{h1}, w_{h2}), the rental price of land (p_{r1}, p_{r2}) or the direct cost of schooling $(C(S))$, although in the latter case we can include a proxy for indirect costs $(C'(S))$, which are discussed below.[11] Taking these changes into account, we obtain the following expression for the participation equation:

$$ACT_{c1} = g_1\left(A_o, Y_1, K_o, C'(S); Z, e\right). \tag{18}$$

Due to the rather large observed differences in the participation rates of male and female children, separate equations are estimated for boys and girls.[12] As there are potentially several observations from the same household, the standard errors are adjusted to allow for correlation between observations within clusters. The dependent variable consists of five unique outcomes as defined above, with children participating in "own household work" categorized as participating in domestic work. In the cases where a child both works and attends school we will assign them to the activity they have listed as their primary occupation.[13] Due to the nature of the dependent variable, we estimate the model using multinomial logit regression.[14]

The amount of land owned by the household (A_o) is measured in acres, and we include dummy variables for different sizes of land holdings to allow for a nonlinear relationship. The amount of land owned is typically treated as exogenous, given that land is usually inherited and land markets tend to be weak (Bhalotra and Heady, 2003; Swain, 2001). Leased land, however, may be endogenous in the case of family work, i.e. a family may lease in because they

[10] The relationship between Y_1 and ω_0 may be somewhat tentative; however, substituting household income for initial wealth is preferable to not including the variable at all, as we wish to separate out the substitution and credit market effects of land from the income effect.

[11] We do have information on the village level agriculture and non-agriculture wages for men, women and children. We choose not to use these, however, as they are correlated with household income, and may better reflect village level productivity than the wages paid by an individual household to hired labor.

[12] Further, a likelihood ratio test performed after multinomial logit estimation rejects the null hypothesis that boys and girls have the same likelihood ratio function.

[13] This is in keeping with the theoretical model, where it was assumed that children do not combine activities. Further, it is reasonable to assume that the primary occupation is the most relevant one for analysis.

[14] If we had allowed for children to combine activities, the model would have to be estimated using multinomial probit regression. In this case, however, we do not believe that multinomial probit is appropriate, given the tiny percentage of children reported to combine activities and the presumably large degree of measurement error of combining activities.

have child labor readily available. Therefore, we include a dummy variable to determine if a household leases in land. This variable is expected to have a coefficient of zero if leased land is not endogenous, while the coefficient is expected to be positive if it is endogenous.

The amount of owned productive capital (K_o) is measure by a weighted index of productive assets owned by the household. Total household income, which includes the imputed value of agricultural output, serves as our measure of Y_1. As mentioned above, we do not have any information on the direct costs of schooling ($C(S)$), but we proxy this by including dummy variables which measure whether or not a primary school is in the village, a middle school is within 2km of the village and a high school is within 4km of the village.[15] As we only have data from a single cross-section, it is not possible to include any second period variables. Taken together, these variables constitute the variables of importance given in (18).

Of the above variables, household income may be problematic. Indeed, there is a risk of a simultaneity bias when children contribute to household income either through unpaid family work or through wage labor. Therefore, we choose to instrument household income. Household size and composition, the primary occupation and education level of the father and mother as well as a weighted index of non-productive assets owned by the household are used as instruments. Further, we include village level variables such as the condition of the road leading to the village, the distance from the village to the nearest bus stop, the presence of a market in or within 3km of the village and the proportion of irrigated land. State control dummies are also included.

As for child specific characteristics, we include the child's age as a regressor in the estimation. This follows from Becker's human capital theory, which predicts that both education and experience will increase the marginal product of labor. While we do not have information on the number of years of schooling the child has, we can use age as a proxy for experience. We also include the birth order of the child among all members of the household up to 18 years of age. Further, we include a dummy variable indicating whether or not the child is the biological child of the household head in the regression. We include this for three reasons. The first two have to do with parental agency. First, the household head may act more altruistically towards their own child than towards other children in the household. As a result, we expect the chil-

[15] While we do have data on total expenditure on education for the households, this is not the same as the direct cost of schooling, and is clearly highly endogenous. Hence, we choose to utilize the indirect measures of cost of schooling mentioned above.

dren of the household head to be more likely to attend school and less likely to work. However, if the household head is more likely to exert control over the income generated by own child labor, then there is an incentive to send own children to work.[16] Finally, if the child of the household head is expected to inherit the family land, their may be more incentive to employ the child in family work, as the future returns to such experience may outweigh the increase in future wages expected from schooling. Therefore, we cannot be certain of the effect of being the child of the household head on participation in work versus schooling.

The education level of each parent is also included as regressors in the estimation. These are dummy variables measuring primary, middle and secondary education, with the base category being illiteracy. Primary education means that the parent is literate, but that the highest level of education attained is primary or lower. Middle education means that the parent has attained an educational level above primary but less than matriculation, while secondary education includes educational attainment of matriculation and higher. The latter two categories are combined in the case of mothers, as the low incidence of mothers with secondary education or higher leads to collinearity in the results otherwise. These variables are included as a measure of parental preferences, as parents with higher education are expected to exhibit a greater preference for schooling. Further, including mother's and father's education separately allows for a degree of preference heterogeneity, as observed empirically by Basu and Ray (2001). The same is true of including the gender of the household head as a regressor, however this may also act as a measure of household insecurity.

Dummy variables indicating that the child's mother or father is absent from the household are also included, as absent parents do not necessarily influence the incidence of child labor to the same degree (U.S. Department of Labor, 2000). Unfortunately, we do not have data indicating why the parent is absent, which may play an important role in how these variables affect child activity. For example, a parent may be absent because he or she has migrated in order to take a job. They may, however, be absent because they are deceased. The reason for the parent's absence may have very different effects on child labor and schooling. Further, the effects may be gender specific with respect to both the missing parent and the child.

[16] This possible effect is supported by the theory and results presented in Basu and Ray (2001).

Table 4: Definitions and summary statistics of the variables.

Variable	Definition	Full Sample		Boys		Girls	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
School	Dependent variable=0 if child's primary or secondary occupation is school attendance.	0.6909	0.4621	0.7560	0.4295	0.6183	0.4858
Idle	Dependent variable=1 if child does not have a primary or secondary occupation.	0.2084	0.4061	0.1784	0.3828	0.2418	0.4282
Domestic work	Dependent variable=2 if child's primary or secondary occupation is own household domestic work.	0.0466	0.2108	0.0133	0.1144	0.0838	0.2771
Family work	Dependent variable=3 if child's primary or secondary occupation is family work.	0.0212	0.1441	0.0167	0.1282	0.0262	0.1597
Non-family work	Dependent variable=4 if child's primary or secondary occupation is non-family work.	0.0329	0.1784	0.0356	0.1853	0.0299	0.1703
ln(household income)	The log of total household income.	9.9015	0.8669	9.9004	0.5310	9.9027	0.5380
Household owns land	Dummy=1 if the household owns land.	0.6806	0.4663	0.6810	0.4661	0.6801	0.4665
Household owns 15 to 29 acres of land[d)]	Dummy=1 if the household owns 15 to 29 acres of land.	0.1478	0.3549	0.1446	0.3517	0.1514	0.3584
Household owns 30 to 59 acres of land[d)]	Dummy=1 if the household owns 30 to 59 acres of land.	0.1849	0.3882	0.1889	0.3915	0.1804	0.3845
Household owns 60 or more acres of land[d)]	Dummy=1 if the household owns 60 or more acres of land.	0.1821	0.3859	0.1807	0.3847	0.1837	0.3873
Household leases in land	Dummy=1 if the household leases in land.	0.0682	0.2520	0.0667	0.2496	0.0698	0.2548
Household owns productive assets	Dummy=1 if the household owns any productive assets.	0.3499	0.4770	0.3481	0.4764	0.3520	0.4776
Index of productive assets	Weighted index of productive assets owned by the household.	2.6806	5.2753	2.6761	5.3034	2.6856	5.2438
No anganwandi in village	Dummy=1 if there is no anganwandi in the village.	0.5002	0.5000	0.5059	0.5000	0.4939	0.5000
No primary school in village	Dummy=1 if there is no primary school in the village.	0.1155	0.3196	0.1157	0.3199	0.1152	0.3192
No middle school w/in 2km	Dummy=1 if there is no middle school within 2km of the village.	0.3003	0.4584	0.3049	0.4604	0.2952	0.4562
No high school w/in 4km	Dummy=1 if there is no high school within 4km of the village.	0.2400	0.4271	0.2478	0.4317	0.2313	0.4217
Child's age	The age of the child in years.	10.39	2.29	10.4156	2.2876	10.3569	2.2882
Child's age squared	The age of the child in years, squared.	113.14	48.12	113.72	48.17	112.50	48.07
Birth order	Age-rank among individuals aged up to 17 in the household.	2.1208	1.1325	2.1043	1.1300	2.1391	1.1350
Child of the household head	Dummy=1 if child is the child of the household head.	0.7822	0.4128	0.7851	0.4108	0.7790	0.4149
Father primary education	Dummy=1 if child's father has primary education.	0.2483	0.4320	0.2421	0.4283	0.2552	0.4360
Mother primary education	Dummy=1 if child's mother has primary education.	0.1584	0.3651	0.1540	0.3610	0.1633	0.3696

Father middle education	Dummy=1 if child's father has middle education.	0.1258	0.3317	0.1265	0.3324	0.1251	0.3308
Father secondary education	Dummy=1 if child's father has secondary education or above.	0.1541	0.3611	0.1557	0.3625	0.1524	0.3594
Mother middle/secondary education	Dummy=1 if child's mother has middle education or above.	0.0888	0.2845	0.0887	0.2844	0.0889	0.2847
Mother absent	Dummy=1 if the child's mother is not present in the household.	0.0338	0.1807	0.0329	0.1783	0.0348	0.1833
Father absent	Dummy=1 if the child's father is not present in the household.	0.0632	0.2433	0.0600	0.2375	0.0667	0.2496
Household size	Number of individuals in the household.	7.4457	3.4295	7.3085	3.3894	7.5988	3.4673
Number of males 60+	Number of males aged 60 and over in the household.	0.2043	0.4132	0.2063	0.4154	0.2021	0.4107
Number of females 60+	Number of females aged 60 and over in the household.	0.1872	0.4013	0.1889	0.4016	0.1854	0.4009
Number of females 15-59	Number of females aged 15 - 59 in the household.	1.7914	1.1740	1.7802	1.1588	1.8040	1.1907
Number of males 0-3	Number of males aged 0 - 3 in the household.	0.2820	0.5555	0.2570	0.5339	0.3098	0.5774
Number of females 0-3	Number of females aged 0 - 3 in the household.	0.2665	0.5444	0.2509	0.5298	0.2840	0.5596
Number of males 4-6	Number of males aged 4 - 6 in the household.	0.3232	0.5562	0.3038	0.5477	0.3449	0.5647
Number of females 4-6	Number of females aged 4 - 6 in the household.	0.3011	0.5443	0.2832	0.5304	0.3212	0.5588
Number of males 7-14	Number of males aged 7 - 14 in the household.	1.2423	0.9529	1.6993	0.8120	0.7326	0.8323
Number of females 7-14	Number of females aged 7 - 14 in the household.	1.1615	0.9988	0.6571	0.8212	1.7239	0.8705
Female household head	Dummy=1 if the household head is female.	0.0401	0.1963	0.0394	0.1947	0.0409	0.1981
Bank/coop in village	Dummy=1 if there is a bank or co-op in the village.	0.1979	0.3984	0.1967	0.3975	0.1991	0.3994

Variables measuring household composition and size are used as regressors, with the number of females aged 15 - 59 as the comparison category. Finally, we include two additional village level regressors: a dummy taking the value of one if there is no anganwandi in the village and a dummy variable taking the value of one if there is a bank or cooperative present in the village. An anganwandi is a child care center for children under the age of six. It also provides services to pregnant and nursing mothers. hence, this variable is intended to capture access to child care. The second variable is intended to provide a proxy for the household's access to credit.

Religion and ethnicity dummies are included (but not reported) to capture differences in preferences between these groups, but also to capture the potential effects of discrimination in the case of the scheduled tribes and scheduled castes. Dummy variables indicating which state the household is located in are also included as controls, and are also not reported. Table 4 reports the summary statistics for the independent variables of interest to the analysis.

5 Results

As mentioned in section 4 above, household income is potentially endogenous in the cases of family and non-family work. When we run our regressions including non-instrumented log household income, we find that the variable is negative and insignificant in the case of boys' family work participation, while it is positive and insignificant in the case boys' non-family work participation. In the girls' regression, non-instrumented log household income is positive and significant in the case of participation in non-family work. These results indicated that household income is indeed endogenous, at least in the case of non-family work. Therefore, we include instrumented household income as an independent variable in our regressions through a non-simultaneous two-stage process. The natural log of total household income is first instrumented by means of an OLS regression on the variables listed in section 4. The predicted values from this regression are then included as an independent variable in the multinomial logit regressions. The standard errors of the predicted values of household income will be smaller than would be the case with a simultaneous estimator, and the results must be interpreted with this in mind (Wooldridge, 1999). Another alternative is to estimate the regressions using instrumental probit to obtain a simultaneous estimator for household income. This is possible in Stata; however, in this case the standard errors cannot be adjusted for clustering by household. The results of the instrumental pro-

bit regressions (not reported) yield nearly identically significant household income coefficients, indicating that the non-simultaneous method does not introduce a significant bias.

Wald tests run for both regressions rejected the hypothesis that two or more categories had equal coefficients on the independent variables. This result supports our decision to separate child work into different categories.

One assumption of the multinomial logit model is that of the irrelevance of independent alternatives (IIA). In order to test this assumption, a generalized Hausman test is run on the regression results. The results of the test reveal that the assumption of IIA is violated in both regressions. Specifically, the category idle is problematic in both the boys' and girls' regressions, while the category domestic work is problematic in the girls' regression. One option would be to use nested logit to estimate the empirical model. The disadvantage of this method is that it does not allow for clustering by household. Further, attempts to use nested logit showed that the results were unstable and often did not converge. With this in mind, we choose to rely on the multinomial logit results.

Table 5 and table 6 present the multinomial logit estimation of boys' and girls' participation in primary occupation categories, respectively.

5.1 Household income, land and productive assets

Household income has a strongly significant negative effect on participation in all non-school activities. While this result may seem intuitively apparent it is not self-evident, especially considering the weak relationship between household income and child labor reported in other studies (see Bhalotra and Tzannatos (2003) for an overview).[17] A strong negative effect of household income on work participation should not be interpreted as support for the hypothesis of compelling poverty, however, as a negative effect rather indicates that consumption of schooling acts as a normal good, or it may indicate a credit constraint.[18]

[17] To further investigate whether or not log household income is endogenous, we include the residuals from the OLS regression along with unistrumented household income as an independent variables in the multinomial logit regression. If household income is truly exogenous, we would expect the coefficient on the residuals to be zero (Bhalotra and Heady, 2003). For both boys and girls, however, the coefficient is positive and significant in all cases.

[18] The only tests of compelling poverty that we are aware of are the ones developed and tested by Bhalotra (2004) and Dumas (2004). Using data on children engaged in wage labor from rural Pakistan, Bhalotra finds strong evidence supporting the hypothesis for boys, while the hypothesis is weakly supported for girls. Dumas uses data on children engaged in farm labor in Burkina Faso, and does not find support for the hypothesis of

Table 5: Multinomial logit estimation of boys' participation in primary occupation categories.

	Dependent variable: Primary occupation category			
Household income, land and productive assets:	*Idle*	*Domestic work*	*Family work*	*Non-family work*
ln(household income)[(+)]	-0.7759***	-0.9488***	-0.9778***	-1.4036***
	(0.1167)	(0.3487)	(0.2719)	(0.2152)
Household owns land[d)]	-0.1843**	-0.0233	0.7889***	-0.1394
	(0.0759)	(0.1981)	(0.2201)	(0.1342)
Household owns 15 to 29 acres of land[d)]	0.0274	0.0110	0.2842	-0.2837*
	(0.0888)	(0.2470)	(0.2139)	(0.1699)
Household owns 30 to 59 acres of land[d)]	0.1133	-0.0615	0.6282***	-0.2255
	(0.0876)	(0.2502)	(0.2079)	(0.1655)
Household owns 60 or more acres of land[d)]	0.2245**	0.0986	0.9512***	-0.5874***
	(0.0972)	(0.2467)	(0.2332)	(0.2153)
Household leases in land [d)]	0.0367	-0.1695	0.6191***	-0.2980
	(0.0933)	(0.2826)	(0.2023)	(0.2155)
Household owns productive assets [d)]	-0.2567***	-0.4445*	-0.4697**	-0.2158
	(0.0778)	(0.2404)	(0.2095)	(0.1656)
Index of productive assets	-0.0148*	0.0012	0.0165	-0.0145
	(0.0084)	(0.0248)	(0.0197)	(0.0201)
School availability:				
No primary school in village [d)]	0.0959	-0.0937	0.1452	0.4101***
	(0.0800)	(0.2327)	(0.2219)	(0.1592)
No middle school w/in 2km [d)]	0.1202**	-0.0713	-0.0712	-0.2034*
	(0.0605)	(0.1752)	(0.1590)	(0.1149)
No high school w/in 4km [d)]	0.0464	0.0828	-0.0056	0.0072
	(0.0662)	(0.1952)	(0.1800)	(0.1282)
Child characteristics:				
Child's age	-0.0770***	0.2648***	0.5002***	0.4694***
	(0.0124)	(0.0363)	(0.0376)	(0.0296)
Birth order	0.0803**	-0.0336	0.0098	-0.1345*
	(0.0316)	(0.0898)	(0.0966)	(0.0725)
Child of the household head [d)]	-0.0692	0.0356	0.2215	0.4691**
	(0.0806)	(0.2257)	(0.2238)	(0.1909)
Parental characteristics:				
Father primary education [d)]	-0.9725***	-0.6484***	-0.7150***	-0.6887***
	(0.0659)	(0.1716)	(0.1622)	(0.1204)
Mother primary education [d)]	-1.1739***	-0.7793**	-0.5669**	-0.7373***
	(0.1198)	(0.3147)	(0.2341)	(0.1946)
Father middle education[d)]	-1.1349***	-1.7973***	-1.1154***	-1.2379***
	(0.0944)	(0.4145)	(0.2657)	(0.2187)
Father secondary education [d)]	-1.3597***	-0.9517**	-1.5062***	-1.4870***
	(0.1124)	(0.3841)	(0.4276)	(0.3348)
Mother middle/secondary education [d)]	-0.7022***	-0.3304	-2.5149**	-1.0231**
	(0.1780)	(0.5505)	(1.0440)	(0.4375)

Mother absent [d)]	0.3265***	0.6435**	-0.0951	0.6552***
	(0.1261)	(0.3129)	(0.3072)	(0.2142)
Father absent [d)]	-0.6691***	-0.8021**	-0.1138	-0.5581**
	(0.1378)	(0.3694)	(0.3388)	(0.2603)
Household characteristics:				
Household size	0.1585***	0.2162**	0.0920	0.2143***
	(0.0338)	(0.0889)	(0.0898)	(0.0666)
Number of males 60+	0.0378	0.1787	0.0369	0.2542
	(0.0749)	(0.2035)	(0.1905)	(0.1564)
Number of females 60+	-0.3456***	-0.3231	-0.0886	-0.3773**
	(0.0801)	(0.1993)	(0.1768)	(0.1648)
Number of females 15-59	-0.2468***	-0.2283*	-0.3273**	-0.3508***
	(0.0554)	(0.1355)	(0.1326)	(0.1005)
Number of males 0-3	-0.0727	0.1815	0.1286	0.1881
	(0.0592)	(0.1681)	(0.1678)	(0.1217)
Number of females 0-3	0.0095	0.0297	0.1648	-0.1564
	(0.0589)	(0.1613)	(0.1624)	(0.1289)
Number of males 4-6	-0.1007*	-0.1255	0.1710	-0.2610**
	(0.0559)	(0.1533)	(0.1581)	(0.1194)
Number of females 4-6	-0.1494**	-0.2698*	0.1738	-0.2027*
	(0.0585)	(0.1535)	(0.1417)	(0.1144)
Number of males 7-14	0.0049	-0.1166	-0.1280	0.0049
	(0.0455)	(0.1213)	(0.1156)	(0.0927)
Number of females 7-14	-0.2093***	-0.1578	-0.1127	-0.1425*
	(0.0451)	(0.1117)	(0.1109)	(0.0860)
Female household head [d)]	0.2949*	0.4709	0.1957	0.8541***
	(0.1507)	(0.3820)	(0.3869)	(0.2595)
Village characteristics:				
Bank/coop in village [d)]	-0.1032	-0.3282	-0.2396	-0.0804
	(0.0645)	(0.2127)	(0.1658)	(0.1294)
No anganwandi in village [d)]	0.1504***	0.1408	-0.1517	0.0124
	(0.0550)	(0.1515)	(0.1364)	(0.1042)
N	19318			
Pseudo-R^2	0.2016			

Note: Primary occupation category ”school” is the comparison group. Standard errors are adjusted for clustering by household and in parentheses. Coefficients with the superscript *** are significant at the 1% level, **are significant at the 5% level, *are significant at the 10% level. The superscript (+) indicates that the variable is a non-simultaneous instrumental variable, and that the standard errors are not strictly accurate. The superscript d) indicates a dummy variable. Control variables for religion, ethnicity and state as well as an intercept are included, but the results are not reported here.

Table 6: Multinomial logit estimation of girls' participation in primary occupation categories.

	Dependent variable: Primary occupation category			
Household income, land and productive assets:	*Idle*	*Domestic work*	*Family work*	*Non-family work*
ln(household income)[(+)]	-1.3007***	-1.4405***	-1.2103***	-2.1059***
	(0.1159)	(0.1583)	(0.2416)	(0.2648)
Household owns land[d)]	-0.0586	-0.0490	-0.1313	-0.4529**
	(0.0775)	(0.1081)	(0.1803)	(0.1760)
Household owns 15 to 29 acres of land[d)]	0.1697*	0.2719**	0.1648	0.1339
	(0.0872)	(0.1222)	(0.2111)	(0.2034)
Household owns 30 to 59 acres of land[d)]	0.2239**	0.2971**	0.3330*	-0.2229
	(0.0877)	(0.1218)	(0.1983)	(0.2200)
Household owns 60 or more acres of land[d)]	0.3349***	0.3493***	0.6046***	-0.5489*
	(0.0995)	(0.1336)	(0.2197)	(0.2871)
Household leases in land [d)]	0.2309**	0.1923	0.4844**	0.0703
	(0.0934)	(0.1270)	(0.2132)	(0.2245)
Household owns productive assets [d)]	-0.1455*	-0.3346***	-0.0161	-0.1411
	(0.0803)	(0.1068)	(0.2041)	(0.2101)
Index of productive assets	-0.0148*	0.0233**	-0.0035	0.0105
	(0.0081)	(0.0100)	(0.0249)	(0.0278)
School availability:				
No primary school in village [d)]	0.0437	0.0656	-0.0443	-0.0993
	(0.0816)	(0.1192)	(0.2247)	(0.2371)
No middle school w/in 2km [d)]	0.1449**	-0.0266	-0.1549	-0.1429
	(0.0632)	(0.0861)	(0.1433)	(0.1432)
No high school w/in 4km [d)]	0.1184*	0.1482	0.1448	0.2293
	(0.0701)	(0.0952)	(0.1608)	(0.1544)
Child characteristics:				
Child's age	-0.0670***	0.4691***	0.4248***	0.5107***
	(0.0135)	(0.0192)	(0.0311)	(0.0323)
Birth order	0.0501	0.0002	-0.0257	-0.1784**
	(0.0319)	(0.0468)	(0.0927)	(0.0803)
Child of the household head [d)]	0.0166	0.1414	0.4723**	0.4461*
	(0.0823)	(0.1210)	(0.2155)	(0.2344)
Parental characteristics:				
Father primary education [d)]	-0.7850***	-0.6048***	-0.7309***	-0.6789***
	(0.0633)	(0.0851)	(0.1361)	(0.1343)
Mother primary education [d)]	-1.0356***	-0.8613***	-0.8847***	-0.7946***
	(0.0989)	(0.1376)	(0.2005)	(0.2220)
Father middle education[d)]	-0.9904***	-0.9820***	-0.8900***	-1.5579***
	(0.0894)	(0.1356)	(0.2087)	(0.3139)
Father secondary education [d)]	-1.4412***	-1.1272***	-1.7944***	-1.0028***
	(0.1108)	(0.1637)	(0.3804)	(0.3662)
Mother middle/secondary education [d)]	-1.1486***	-1.5647***	-1.6866***	-2.2263***
	(0.1756)	(0.3039)	(0.6315)	(0.7245)

Mother absent [d)]	0.2037	1.0181***	0.8144***	0.6315**
	(0.1349)	(0.1526)	(0.2701)	(0.2738)
Father absent [d)]	-1.0552***	-0.6535***	-0.4157	-0.6066**
	(0.1391)	(0.1781)	(0.2881)	(0.2907)
Household characteristics:				
Household size	0.1658***	0.1585***	0.0689	0.2891***
	(0.0351)	(0.0471)	(0.0820)	(0.0767)
Number of males 60+	-0.0658	-0.0580	0.0726	0.1880
	(0.0773)	(0.1051)	(0.1822)	(0.1841)
Number of females 60+	-0.3042***	-0.1945*	-0.0089	-0.5285***
	(0.0781)	(0.1089)	(0.1806)	(0.1946)
Number of females 15-59	-0.1749***	-0.1840**	-0.1609	-0.3042**
	(0.0545)	(0.0749)	(0.1204)	(0.1204)
Number of males 0-3	0.0770	0.0558	0.2385*	0.0486
	(0.0604)	(0.0849)	(0.1412)	(0.1336)
Number of females 0-3	-0.0398	0.0685	0.1610	-0.0346
	(0.0595)	(0.0833)	(0.1377)	(0.1423)
Number of males 4-6	-0.0124	-0.0128	-0.1783	-0.1495
	(0.0549)	(0.0853)	(0.1447)	(0.1315)
Number of females 4-6	-0.0267	-0.0334	0.1170	-0.1736
	(0.0564)	(0.0821)	(0.1345)	(0.1454)
Number of males 7-14	-0.0368	-0.0605	-0.0333	-0.0734
	(0.0451)	(0.0604)	(0.1061)	(0.1012)
Number of females 7-14	-0.1176**	-0.0818	0.0507	-0.0237
	(0.0463)	(0.0586)	(0.1053)	(0.0982)
Female household head [d)]	0.0350	-0.0531	-0.1653	0.1810
	(0.1607)	(0.2115)	(0.3366)	(0.2924)
Village characteristics:				
Bank/coop in village [d)]	-0.1768***	-0.0895	-0.0954	-0.1724
	(0.0657)	(0.0936)	(0.1545)	(0.1622)
No anganwandi in village [d)]	0.2444***	0.1334*	0.0549	0.1753
	(0.0561)	(0.0787)	(0.1224)	(0.1242)
N	17325			
Pseudo-R^2	0.2515			

Note: Primary occupation category ”school” is the comparison group. Standard errors are adjusted for clustering by household and in parentheses. Coefficients with the superscript *** are significant at the 1% level, **are significant at the 5% level, *are significant at the 10% level. The superscript (+) indicates that the variable is a non-simultaneous instrumental variable, and that the standard errors are not strictly accurate. The superscript d) indicates a dummy variable. Control variables for religion, ethnicity and state as well as an intercept are included, but the results are not reported here.

Turning to the land variables, we see that the wealth paradox exists for boys participating in family work, and that the relationship between the amount of land owned by the household and family work is positive and nonlinear for both boys and girls. As discussed above, market imperfections will influence the relationship between land holdings and child family labor in two ways. If the credit market is imperfect, then increased land holdings are expected to decrease the incidence of child family labor. The opposite is true in the presence of land and labor market imperfections. Therefore, the observation that land has a significantly positive effect on child participation in family work indicates that the land and labor markets are imperfect. We cannot conclude, however, that the credit market is perfect; it could be the case that the effect of the credit market imperfection is overwhelmed by the incentive created by the land and labor market imperfection.

Boys are significantly less likely to be idle in households that own land, while the effect of owning land on participation in non-family work is significantly negative in the case of girls. Similarly, there is a significant and negative relationship between the amount of land owned by the household and participation in non-family work. This may indicate a credit market imperfection, but may also reflect income effects of land if our measure of household income does not fully capture these effects. The relationship between the amount of land owned by the household and child idleness is positive and nonlinear for girls.

When the household leases in land, girls are significantly more likely to be idle, and both boys and girls are significantly more likely to participation in family work. This would seem to indicate that households that lease in land do so taking into account that they can employ the child on the land. Finally, the land variables have no effect on the participation of boys in domestic work.

Children in households that own productive assets are significantly less likely to be idle or participate in domestic work, and boys in these households are less likely to participate in family work. The amount of productive assets owned is significantly negatively related to child idleness, while it is positively and significantly related to girls' participation in domestic work. Clearly, productive assets do not exhibit the same effect as land on family labor. This may be due to a smaller substitution effect of productive assets than land. If the productive assets require more skills to operate, then child labor might not be a viable substitute for adult labor. In this case, credit market imperfections

compelling poverty.

may dominate.

5.2 School availability

There is a positive and significant relationship between child idleness and the absence of a middle school within 2 km of the village, and girls are more likely to be idle if there is no high school within 4 km of the village. The absence of a primary school in the village is positively and significantly related to boys' participation in non-family work, while the absence of a middle school is negatively and significantly related to boys' participation in non-family work. While the first result is reasonable, the second result is counter-intuitive, and may indicate that the distance to middle school is not a significant obstacle to school attendance, and that this variable is capturing other village level effects.

5.3 Child characteristics

The relationship between age and child participation in any form of work is significant and positive, while it is significant and negative for child idleness. These results are in line with human capital theory. Birth order is significant in the case of idle boys and children participating in non-family work. In the former case the relationship is positive, while in the latter it is negative. Finally, the dummy variable indicating the child of the household head is significant and positive for girls participating in family work and children participating in non-family work. This may reflect that the household head is more likely to control the income generated from the labor of their own children rather than other children, in which case the incentive to send their own children to work is stronger.[19]

5.4 Parental characteristics

The educational attainment of both fathers and mothers exhibits a significantly negative relationship to participation in all forms of non-school activity, with the only exception being mothers with middle/secondary education in the case of boys' participation in domestic work. This lends support to the hypothesis that educated parents have a stronger preference for schooling.

An absent mother is significantly and positively related to participation in all forms of non-school activity with the exception of idle girls and boys

[19] This interpretation is similar to the results in Basu and Ray (2001), where preference heterogeneity and greater inequality in relative bargaining power between parents increases child labor.

participating in family work, where the effect is zero. This could indicate that child labor acts as a substitute for female labor in these cases. An absent father is negatively related to participation in all forms of non-school activity, but is not significant in the case of family work. This may indicate that absent fathers are primarily migrant workers, sending money home to facilitate their children's school attendance.

5.5 Household characteristics

Children from larger households are more likely to participate in any form of non-school activity, although the effect is not significant in the case family work. This may be due to the fact that, in the case of family labor, the marginal product of child labor is decreasing in the number of family members employed in the family enterprise, and as such the incentive to employ children is diminished as household size increases.

The variables measuring household composition (with the number of adult males in the household as the base category) indicate that an increase in the number of females in the household decreases the likelihood that the child participates in some form of non-school activity. These results are particularly strong in regards to the number of adult females and females over age 60 (with the exception of girls participating in family work). Therefore, children that come from households with a high proportion of adult women are more likely to attend school. This could indicate that female labor is a stronger substitute for child labor, or that adult females have a higher preference for child schooling than males.

Finally, boys from households headed by a female are significantly more likely to be idle or participate in non-family work than to attend school.

5.6 Village characteristics

The measure intended to capture access to credit markets, the presence of a bank or cooperative in the village, is negatively related to participation in all non-school activity but is only significant in the case of idle girls. The coefficient on the variable measuring the absence of an anganwandi in the village is positive and significant in the case of idle children and girls participating in domestic work. This suggests that the availability of child care does not affect the decision to send children to directly income-generating work rather than school.

5.7 Marginal effects

Table A1 and table A2 in Appendix 2 present the marginal effects from the multinomial logit regressions on estimated probabilities for participation in primary occupation categories for boys and girls, respectively. The results are straightforward except in the case of income, which is in logs, and the dummy variables. As a result, the effect of a 10% change in household income can be read directly from the tables, while the marginal effect of a dummy variable is for a discrete change from 0 to 1.

The results indicate that household income and parental education levels have relatively large marginal effects on all estimated participation probabilities. Further, the marginal effects of land ownership and the leasing of land by the household are large in the case of boys' family work participation. The marginal effects of absent parents (particularly mothers) is large in most cases, though less so in the case of non-family work.

5.8 Are idle children really idle?

The results presented in table 5 and table 6 indicate that many of the factors that affect child participation in family work are also significant in the case of idle children, particularly the amount of land owned by the household. This may indicate that many of the children classified as idle are in fact participating in family work. In some instances, these children may be working less than half the year (in which case family work would not be considered their main occupation), while in others it may be a reporting error. Further, children are significantly more likely to be idle if there is no anganwandi present in the village, which indicates that many of these children may be taking care of younger siblings.

The empirical analysis has not included measures of the quality or the direct cost of schooling due to data limitations. There is evidence, however, that parents may refrain from sending their children to school if the quality of the school is low and/or if the direct costs of schooling are high (see Leclercq (2001) and Drèze and Kingdon (2001), for example). When schooling is not a viable option, it is reasonable to believe that some parents will have their children participate in some form of work rather than do nothing at all. In this case, it may be more likely that the children work less than half the year, in which case work would not be considered their main occupation. The fact that many of the children classified as idle in our sample may in fact be working lends support to the liberal definition of child labor presented in

Jayaraj and Subramanian (2005), where all children who are not attending school are considered to be working.[20]

5.9 Previous results

Both Duraisamy (2000) and Leclercq (2002) have used the same NCAER data set to examine child labor in rural India. Our results are not directly comparable, however, for a number of reasons. Leclercq focuses on North India only, and limits his sample to children aged 10-14, while Duraisamy's sample includes children aged 5-19. Neither author distinguishes between the types of work that children participate in, and both use the idle category as their comparison group. This last point may be particularly problematic, as many of these children may in fact be working.

With these caveats in mind, both Duraisamy and Leclercq find that parental education is a significant determinant of child labor versus schooling. Further, both find a significant negative relationship between measures of household income (unistrumented in Duraisamy's case) and child labor. Leclercq finds strong evidence that child labor, especially in the case of girls, is a substitute for adult female work, while land (measured per capita) is only significant in the case of girls' school attendance. That Leclercq does not find a significant effect of land on participation in work may depend on the fact that idle children are the comparison group, and that he places all working children in one category.

6 Conclusions

When looking at the factors that influence whether or not a child participates in labor, it would appear that household income and parental education play the largest role. Household income has a significant positive effect on school attendance and a significant negative effect on all non-school activities, which indicates that policies directed at raising household income should increase school attendance. Therefore, it may be possible to increase school attendance in the short- to medium-run through means of income redistribution. However, theoretical models have shown that the results of income redistribution on school attendance are ambiguous and depend on the mean income level of the economy (Swinnerton and Rogers, 1999; Rogers and Swinnerton, 2001; Ranjan, 2001). As a result, macroeconomic growth strategies that raise the level of income of the entire society are likely the best long-run policies

[20] For our purposes, the liberal definition of child labor is impractical as we cannot meaningfully allocate idle children between the different types of work analyzed in this paper.

for reducing child labor via household income.

The relatively large negative marginal effects of parental education on all non-school activities indicate that educated parents have a greater preference for sending their children to school. This in turn indicates that increased access to education may be a more effective long term means of reducing child labor and increasing school attendance than either income or land redistribution. The fact that the marginal effects of mothers' education is at times larger than the marginal effects of fathers' education lends further support to the idea that reducing the gender inequality in school attendance may have significant long term results in reducing child labor and increasing school attendance. Indeed, education appears to have a dynastic effect, where educational attainment leads to a virtuous circle, while the lack of education could lead to a poverty trap. Therefore, policies aimed at improving the quality and accessibility of schools may be the most successful in eliminating child labor in the long run.

In terms of the effect of market imperfections on child labor, it would appear that land and labor market imperfections dominate credit market imperfections in the case of family work. This in turn has implications for policy. One implication is that land redistribution will not necessarily work in the same manner as income distribution with respect to child labor. Therefore, policies aimed at improving the functioning of land and labor markets may be desirable. Further, the results may indicate that returns to family work experience outweigh returns to schooling, at least over a range of land holdings. This suggests that one way to reduce child family labor is to improve the quality of schools. This would also likely reduce the number of idle children significantly. School availability seems to have the most significant impact on idle children. Therefore, policies that aim to improve access to schooling may not have an immediate impact on reducing child labor, as they may instead draw children primarily from the pool of idle children. As there are significantly more idle girls than boys, this may help to close the gender gap. Further, as there are significantly more idle children than working children, policies that effect idle children may have the greatest impact on school attendance.

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Appendix 1

Proof of proposition 2. From (12) and (13) it is clear that a smaller value of λ_1 will decrease the likelihood that these equations hold with equality. Conversely, a small value of λ_1 will increase the likelihood that (14) holds with equality. We know from (15) that $\lambda_1 = W\delta\left(\frac{\partial U_2}{\partial X_2}\right)$. Therefore, we want to find $\left(\frac{\partial \lambda_1}{\partial A_o}\right)$, holding the credit market effects of land constant. First, substitute (2a) - (2c) and (3) into (4); then substitute (4) into (6a) or (6b). This allows us to calculate the effect of land on X_2, which in turn allows us to calculate the effect of an increase in land on λ_1. Making these substitutions, the income effect of land can be expressed as:

$$\left(\frac{\partial \lambda_1}{\partial A_o}\right) = W\delta\left(\frac{\partial^2 U_2}{\partial X_2^2}\right)\left(\left(\frac{\partial Y_2}{\partial A_o}\right) + \left(\frac{\partial Y_1}{\partial A_o}\right) g\left(\bullet\right)\right)$$

where W and $g\left(\bullet\right)$ are credit market effects that are held constant. All of the partial derivatives in this expression are positive, with the exception of $\left(\frac{\partial^2 U_2}{\partial X_2^2}\right)$, which is negative (this follows from our assumption that the utility function is concave in X_2). Therefore, the entire expression is negative, i.e. an increase in land has the effect of lowering λ_1. ■

Proof of proposition 3. From (12) and (13) it is clear that a smaller value of λ_1 will decrease the likelihood that these equations hold with equality. Conversely, a small value of λ_1 will increase the likelihood that (14) holds with equality.

From (15) we can express λ_1 as $\lambda_1 = \left(\omega_1\left(\frac{\partial g}{\partial \omega_1}\right) + g\left(\omega_1, A_o; Z\right)\right)\delta\left(\frac{\partial U_2}{\partial X_2}\right)$. Therefore, we want to find $\left(\frac{\partial \lambda_1}{\partial A_o}\right)$, holding the income effects of land constant. As with Proposition 2, we can substitute (2a) - (2c) and (3) into (4) and then substitute (4) into (6b). Further, we substitute (4) into our above expression for λ_1. Making these substitutions, the credit market effect of land can be expressed as:

$$\begin{aligned}\left(\frac{\partial \lambda_1}{\partial A_o}\right) = & W\delta\left(\frac{\partial^2 U_2}{\partial X_2^2}\right)\omega_1\left[\left(\frac{\partial g}{\partial \omega_1}\right)\left(\frac{\partial Y_1}{\partial A_o}\right) + \left(\frac{\partial g}{\partial A_o}\right)\right] \\ & + \left[2\left(\frac{\partial g}{\partial \omega_1}\right)\left(\frac{\partial Y_1}{\partial A_o}\right) + \omega_1\left(\frac{\partial^2 g}{\partial \omega_1^2}\right)\left(\frac{\partial Y_1}{\partial A_o}\right) + \left(\frac{\partial g}{\partial A_o}\right)\right]\delta\left(\frac{\partial U_2}{\partial X_2}\right).\end{aligned} \tag{*}$$

When the household borrows, $\omega_1 < 0$ and the rate of interest the household must pay on the debt is negatively related to both the size of the debt and the amount of land the household can offer as collateral, i.e. $\left(\frac{\partial g}{\partial \omega_1}\right) < 0$ and $\left(\frac{\partial g}{\partial Ao}\right) < 0$. Further, the interest rate paid on the loan falls more slowly as the the size of the loan decreases, i.e. $\left(\frac{\partial^2 g}{\partial \omega_1^2}\right) > 0$. Therefore, it is clear that the entire expression is negative, and that an increase in land holding leads to a smaller value of λ_1, thus decrease the likelihood that children from households with large holdings of land participate in work while increasing the likelihood

that these same children attend school. ■

Proof of proposition 4. As in Proposition 3 above, we are interested in $\left(\frac{\partial \lambda_1}{\partial A_o}\right)$, where λ_1 can be expressed as $\lambda_1 = \left(\omega_1 \left(\frac{\partial g}{\partial \omega_1}\right) + g(\omega_1)\right) \delta \left(\frac{\partial U_2}{\partial X_2}\right)$. Again, we can substitute (2a) - (2c) and (3) into (4) and then substitute (4) into (6a). Finally, we substitute (4) into our above expression for λ_1. Making these substitutions, the credit market effect of land can now be expressed as:

$$\left(\frac{\partial \lambda_1}{\partial A_o}\right) = W\delta \left(\frac{\partial^2 U_2}{\partial X_2^2}\right) \omega_1 \left[\left(\frac{\partial g}{\partial \omega_1}\right)\left(\frac{\partial Y_1}{\partial A_o}\right)\right] \qquad (**)$$
$$+ \left[2\left(\frac{\partial g}{\partial \omega_1}\right)\left(\frac{\partial Y_1}{\partial A_o}\right) + \omega_1 \left(\frac{\partial^2 g}{\partial \omega_1^2}\right)\left(\frac{\partial Y_1}{\partial A_o}\right)\right] \delta \left(\frac{\partial U_2}{\partial X_2}\right)$$

When the household saves, $\omega_1 > 0$ and the rate of interest the household receives is positively related to the amount of of wealth saved, i.e. $\left(\frac{\partial g}{\partial \omega_1}\right) > 0$ and land has no effect on the interest rate, i.e. $\left(\frac{\partial g}{\partial Ao}\right) = 0$. Further, the interest rate paid on savings rises more slowly as the amount saved increases, i.e. $\left(\frac{\partial^2 g}{\partial \omega_1^2}\right) < 0$. Clearly, the first term in (**) is negative, as $\left(\frac{\partial^2 U_2}{\partial X_2^2}\right) < 0$. Further, this term is smaller than the first term in (*) by $\left(\frac{\partial g}{\partial A_o}\right)$. The sign of the first term is ambiguous, and depends on whether $2\left(\frac{\partial g}{\partial \omega_1}\right) + \omega_1 \left(\frac{\partial^2 g}{\partial \omega_1^2}\right) \gtreqless 0$. Due to the concave nature of $g(\omega_1)$, we know that $0 < \left(\frac{\partial g}{\partial \omega_1}\right) < 1$, which in turn implies that $2\left(\frac{\partial g}{\partial \omega_1}\right) < 2$. Therefore, if $\omega_1 < 2\left(\frac{\partial^2 g}{\partial \omega_1^2}\right)^{-1}$, then the second term of the expression is positive; otherwise, the second term is negative. When the second term in (**) is negative, it is smaller than the second term in (*) by $2\left(\frac{\partial g}{\partial \omega_1}\right) + \left(\frac{\partial g}{\partial A_o}\right)$.

In the case where the second term in (**) is positive, the entire expression will still be negative if the first term is larger than the second term. ■

Appendix 2

Table A1: Marginal effects after multinomial logit on estimated probabilities of boys' participation in primary occupation categories.

	Dependent variable: Primary occupation category			
Household income, land and productive assets:	*Idle*	*Domestic work*	*Family work*	*Non-family work*
ln(household income)[(+)]	-0.0787	-0.0067	-0.0044	-0.0141
Household owns land[d)]	-0.0202	0.00002	0.0037	-0.0013
Household owns 15 to 29 acres of land[d)]	0.0031	0.0001	0.0016	-0.0028
Household owns 30 to 59 acres of land[d)]	0.0122	-0.0006	0.0038	-0.0025
Household owns 60 or more acres of land[d)]	0.0248	0.0006	0.0065	-0.0057
Household leases in land [d)]	0.0039	-0.0013	0.0042	-0.0029
Household owns productive assets [d)]	-0.0255	-0.0031	-0.0021	-0.0019
Index of productive assets	-0.0016	0.00003	0.0001	-0.0001
School availability:				
No primary school in village [d)]	0.0098	-0.0009	0.0007	0.0050
No middle school w/in 2km [d)]	0.0133	-0.0007	-0.0004	-0.0023
No high school w/in 4km [d)]	0.0049	0.0006	-0.0001	0.00001
Child characteristics:				
Child's age	-0.0093	0.0022	0.0025	0.0051
Birth order	0.0087	-0.0003	0.00001	-0.0016
Child of the household head [d)]	-0.0082	0.0003	0.0011	0.0046
Parental characteristics:				
Father primary education [d)]	-0.0848	-0.0038	-0.0027	-0.0055
Mother primary education [d)]	-0.0916	-0.0043	-0.0020	-0.0055
Father middle education[d)]	-0.0865	-0.0081	-0.0036	-0.0084
Father secondary education [d)]	-0.1015	-0.0051	-0.0046	-0.0099
Mother middle/secondary education [d)]	-0.0585	-0.0018	-0.0058	-0.0073
Mother absent [d)]	0.0363	0.0063	-0.0007	0.0087
Father absent [d)]	-0.0559	-0.0044	-0.0002	-0.0043
Household characteristics:				
Household size	0.0035	0.0014	0.0001	0.0027
Number of males 60+	-0.0357	-0.0022	-0.0002	-0.0036
Number of females 60+	-0.0252	-0.0016	-0.0015	-0.0034
Number of females 15-59	-0.0082	0.0015	0.0007	0.0021
Number of males 0-3	0.0011	0.0002	0.0008	-0.0017
Number of females 0-3	-0.0103	-0.0009	0.0009	-0.0027
Number of males 4-6	-0.0154	-0.0020	0.0010	-0.0020
Number of females 4-6	0.0007	-0.0009	-0.0006	0.0001
Number of males 7-14	-0.0217	-0.0011	-0.0004	-0.0013
Number of females 7-14	0.0316	0.0041	0.0007	0.0129

Female household head [d]	0.0035	0.0014	0.0001	0.0027
Village characteristics:				
Bank/coop in village [d]	-0.0102	-0.0023	-0.0011	-0.0007
No anganwandi in village [d]	0.0158	0.0010	-0.0009	-0.0001

Note: The superscript d) indicates a dummy variable, and in these cases the marginal effect is for a discrete change from 0 to 1. The marginal effects are calculated at the mean of each variable for each regression.

Table A2: Marginal effects after multinomial logit on estimated probabilities of girls' participation in primary occupation categories.

	Dependent variable: Primary occupation category			
Household income, land and productive assets:	*Idle*	*Domestic work*	*Family work*	*Non-family work*
ln(household income)[(+)]	-0.1713	-0.0576	-0.0101	-0.0143
Household owns land[d]	-0.0072	-0.0016	-0.0013	-0.0038
Household owns 15 to 29 acres of land[d]	0.0222	0.0126	0.0014	0.0007
Household owns 30 to 59 acres of land[d]	0.0305	0.0133	0.0034	-0.0021
Household owns 60 or more acres of land[d]	0.0473	0.0148	0.0071	-0.0043
Household leases in land [d]	0.0323	0.0072	0.0059	0.0001
Household owns productive assets [d]	-0.0179	-0.0146	0.0003	-0.0008
Index of productive assets	-0.0024	0.0013	0.00002	0.0001
School availability:				
No primary school in village [d]	0.0061	0.0030	-0.0006	-0.0008
No middle school w/in 2km [d]	0.0224	-0.0025	-0.0020	-0.0013
No high school w/in 4km [d]	0.0155	0.0062	0.0013	0.0017
Child characteristics:				
Child's age	-0.0158	0.0234	0.0047	0.0040
Birth order	0.0076	-0.0004	-0.0004	-0.0015
Child of the household head [d]	-0.0003	0.0062	0.0047	0.0031
Parental characteristics:				
Father primary education [d]	-0.0957	-0.0207	-0.0058	-0.0037
Mother primary education [d]	-0.1149	-0.0281	-0.0064	-0.0040
Father middle education[d]	-0.1073	-0.0313	-0.0063	-0.0071
Father secondary education [d]	-0.1460	-0.0344	-0.0114	-0.0047
Mother middle/secondary education [d]	-0.1158	-0.0431	-0.0101	-0.0083
Mother absent [d]	0.0116	0.0711	0.0109	0.0050
Father absent [d]	-0.1103	-0.0206	-0.0026	-0.0029
Household characteristics:				
Household size	0.0222	0.0061	0.0003	0.0020
Number of males 60+	-0.0095	-0.0024	0.0010	0.0016

Number of females 60+	-0.0419	-0.0066	0.0007	-0.0037
Number of females 15-59	-0.0231	-0.0073	-0.0013	-0.0021
Number of males 0-3	0.0102	0.0019	0.0025	0.0002
Number of females 0-3	-0.0067	0.0037	0.0019	-0.0003
Number of males 4-6	-0.0011	-0.0004	-0.0020	-0.0012
Number of females 4-6	-0.0036	-0.0014	0.0014	-0.0013
Number of males 7-14	-0.0046	-0.0026	-0.0003	-0.0005
Number of females 7-14	-0.0165	-0.0030	0.0009	0.00001
Female household head [d)]	0.0057	-0.0029	-0.0018	0.0016
Village characteristics:				
Bank/coop in village [d)]	-0.0238	-0.0027	-0.0007	-0.0010
No anganwandi in village [d)]	0.0342	0.0042	0.00003	0.0010

Note: The superscript d) indicates a dummy variable, and in these cases the marginal effect is for a discrete change from 0 to 1. The marginal effects are calculated at the mean of each variable for each regression.