

## Pre-Colonial Political Centralization and Contemporary Development in Uganda

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**Abstract** The importance of pre-colonial history on contemporary African development has become an important field of study within development economics in recent years. In particular (Gennaioli & Rainer, 2007) suggest that pre-colonial political centralization has had an impact on contemporary levels of development within Africa at the country level. We test the (Gennaioli & Rainer, 2007) hypothesis at the sub-national level for the first time with evidence from Uganda. Using a variety of datasets we obtain results which are striking in two ways. First, we confirm the (Gennaioli & Rainer, 2007) hypothesis that pre-colonial centralization is highly correlated with modern-day development outcomes such as GDP, asset ownership and poverty levels, and that these correlations hold at the district, sub-county and individual levels. We also use an instrumental variable approach to confirm this finding using the distance from ancient capital of Mubende as an instrument. However, our second finding is that public goods like immunization coverage and primary school enrolment are not correlated with pre-colonial centralization. These findings are thus consistent with a correlation between pre-colonial centralization and private rather than public goods, thereby suggesting the persistence of poverty and wealth from the pre-colonial period to the present.

**Keywords:** Pre-colonial Political Centralization, Development, Uganda

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# Pre-Colonial Political Centralization and Contemporary Development in Uganda

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## Abstract

The role of pre-colonial history on contemporary development has become an important field of study within development economics. Here we examine the role of pre-colonial political centralization on contemporary development outcomes with detailed sub-national data from Uganda. We use a variety of datasets and obtain two striking results. First, we find that pre-colonial centralization is highly correlated with modern-day development outcomes such as GDP, asset ownership and poverty at the sub-county, district and individual level; additional results using an instrumental variable approach confirm this finding. Second, we find that public goods such as immunization coverage and primary school enrolment, as well as perceptions of local government quality, are not correlated with pre-colonial centralization. These findings are thus consistent with a correlation between pre-colonial centralization and private rather than public goods, thereby suggesting the persistence of poverty and wealth from the pre-colonial period to the present.

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Keywords: Pre-colonial Political Centralization, Development, Uganda

## 1 Introduction

The importance of history on contemporary economic development has become an important field of study within development economics in recent years (cf. Nunn (2009) for an overview). While the impact of colonialism on post-colonial outcomes has long been a focus for scholars, a smaller but growing field of study has developed linking pre-colonial formations and post-colonial developments in former colonies (Green, 2012; Hjort, 2010; Jha, 2008). In one recent example of this trend

Gennaioli and Rainer (2007) suggest that pre-colonial political centralization has had an impact on contemporary levels of development within Africa. Measuring pre-colonial centralization by using data from Murdock (1967), they show a robust positive correlation between the percentage of each country's population that is from a centralized ethnic group and outcomes such as paved roads, immunization, literacy and infant mortality rates.

The analysis presented by (Gennaioli & Rainer, 2007) is provocative and adds to a growing literature on the importance of history for contemporary African development. However, their analysis cannot be considered definitive for at least three reasons. First, their unit of observation is the country level, leaving them with between 24 and 45 observations per regression. Despite their efforts at providing a variety of robustness checks there are nonetheless numerous ways in which such a small sample can produce unreliable results. Secondly, as they acknowledge (Gennaioli & Rainer, 2007, p. 192), if the effect of pre-colonial centralization on contemporary development is to have an effect, it should primarily exist at the sub-national level rather than the national level as differences within countries are reflected at the local level. Finally, the lack of an instrumental variable approach leaves the analysis open to the potential criticism of omitted variable bias and reverse causality, especially if pre-colonial economic development may have contributed both to the development of pre-colonial centralized states and to contemporary development outcomes.

We thereby test the Gennaioli and Rainer (2007) hypothesis at the sub-national level in a single country for the first time. We use the example of Uganda, a map of which can be found in Figure 1, for several reasons. First, Gennaioli and Rainer (2007, pp. 188-191) themselves consider Uganda an ideal case study because it demonstrates large variance in centralization across different parts of the country, leading them to use it as their primary qualitative example for the impact of pre-colonial centralization on post-colonial outcomes. Second, due to decentralization policies that began after the current government took office in 1986, local governments have played a large role in local public goods provision, thereby allowing us to test Gennaioli and Rainer (2007)'s proposed mechanism that centralization has affected development outcomes via local government legitimacy. Third, due to the availability of development data at the district and sub-county level, we are able to use much larger samples than were employed by Gennaioli and Rainer (2007), with 56 to 76 observations at the district level and 958 at the sub-county level. Fourth, due to the fact that Uganda is one of twenty countries in Africa to have been surveyed by the Afrobarometer in its most recent round of surveys in 2008, we can also employ survey data which contains information on assets, public goods, ethnicity and a variety of control variables. Fifth, unlike most African censuses which fail to record any data on ethnicity<sup>1</sup>, the most recent Ugandan census from 2002 contains data on ethnicity disaggregated down to the level of the sub-county, thereby allowing us to construct a detailed picture of pre-colonial centralization. Finally, the use of a single country case study allows us to identify an instrument for pre-colonial centralization which can thereby help to clarify the direction of causality.

[Insert Figure 1 here]

Our results are striking in two ways. First, using a variety of dependent variables we confirm

the Gennaioli and Rainer (2007) hypothesis that pre-colonial centralization is highly correlated with modern-day development outcomes at the district, sub-county and individual levels. These results are robust to the use of various control variables and clustered standard errors; we also use distance from the ancient capital of Mubende as an instrument and find that most of our results become even stronger. However, our second finding is that a number of dependent variables are not correlated with pre-colonial centralization, specifically those that measure public goods provision like immunization and access to hospitals, police and other public services. Moreover, using Afrobarometer results we find that there is no relationship between local levels of pre-colonial centralization and the quality of public services. These findings are thus consistent with a correlation between pre-colonial centralization and private rather than public goods, thereby suggesting the persistence of poverty and wealth from the pre-colonial period to the present.

The paper is organized as follows. First we give an overview of the theory and empirics behind Gennaioli and Rainer (2007) before describing our data, including how we ascribed different levels of pre-colonial complexity to each of Uganda's 55 ethnic groups. Second, we present our empirical analysis, using data at the district, sub-county and individual levels as well as the use of an instrumental variable. Third, we show how our results differ according to private vs. public goods. Fourth and finally, we conclude.

## 2 Theoretical and Empirical Overview

There is a growing emphasis within development economics on the role of history in determining contemporary development outcomes. Much of this recent work owes to the seminal influence of Acemoglu, Johnson and Robinson (2001), who argue that the quality of colonial institutions are an important determinant of economic development across the post-colonial world. While much of this work has examined the legacies of colonialism, a small but growing literature has discussed the role of the pre-colonial period in determining modern-day outcomes. For instance, Green (2012) shows that low pre-colonial population densities in Africa led colonizers to construct large states with artificial straight-line borders, while Huillery (2011) has shown that the congruence between pre-colonial and post-colonial wealth patterns in French West Africa is due to European tendencies to settle in rich yet peaceful areas. In southern Africa Hjort (2010) argues that Botswana's post-colonial success derives from pre-colonial cultural characteristics that favored good inter-ethnic relations, democratic institutions and individual property rights. Finally, in India Jha (2008) shows a positive correlation between pre-colonial trade and contemporary peaceful Muslim-Hindu relations.

In one recent provocative article Gennaioli and Rainer (2007) argue that pre-colonial centralization is a determinant of post-colonial African development. They measure pre-colonial centralization by using data from Murdock (1967), which lists data about ethnic groups from around the world along a variety of dimensions. One of these dimensions is political complexity, which ranges from 0

for acephalous or stateless societies such as the Kikuyu (Kenya) and Nuer (Sudan) to 4 for highly centralized groups like the Javanese and Vietnamese. Using this data Gennaioli and Rainer (2007) thus calculate the percentage of each African country's population that is a member of an ethnic group with a pre-colonial complexity score of 2 or higher. They then regress contemporary measures of paved roads, immunization, literacy and infant mortality rates on political centralization and find robust statistically significant relationships between centralization and all five public goods. They claim that the mechanism linking pre-colonial centralization to modern-day development outcomes is the legitimacy of local government institutions, such that more centralized groups have been able to introduce modern technologies and coordinate government activities better than non-centralized groups.

Gennaioli and Rainer (2007)'s argument is intriguing but cannot be considered definitive, in part due to the low number of observations in their sample. More recently Michalopoulos and Papaioannou (2012) use satellite images to examine the impact of pre-colonial centralization on regional nighttime light density. In their analysis the basic unit of observation for pre-colonial centralization is the ethnic group, while their observational unit for light density is the ethnic group homeland. As with Gennaioli and Rainer (2007) they show a robust positive impact of pre-colonial centralization on contemporary outcomes, both at the ethnic group level and at the sub-ethnic group level of the pixel from their luminosity data. However, by using the level of pre-colonial centralization for the entire ethnic homeland Michalopoulos and Papaioannou (2012) assume that the level of political centralization was a constant across each ethnic homeland, an implausible assumption given the rich literature on how even the most centralized pre-colonial African states saw their power trail off as one got closer to their borders (see Herbst (2000) for a general overview). Indeed, the core of 19th-century Burundi was controlled by the *Mwami* (king) while outlying regions were instead ruled over by various princes and chiefs (Lemarchand, 1994; p. 37); in Rwanda as well the state controlled the core but the peripheral populations near its borders lived more autonomously and "were perceived pejoratively as not very 'Rwandan'" (Chrétien, 2003, p. 161). Indeed, the literature suggests a strong link between declining political influence as one travelled outwards from the state core and a declining tendency to identify ethnically with the state's core ethnic group (Chrétien, 2003; Green, 2008).<sup>2</sup>

Thus in contrast to Gennaioli and Rainer (2007) and Michalopoulos and Papaioannou (2012) we examine here the role of pre-colonial centralization at the sub-national level in Uganda. Not only is Uganda a good case study for the reasons noted above but, by using local districts and sub-counties as our units of observations and measuring the percentage of the population within each unit that is from a centralized ethnic group, we are able to avoid the assumption of local uniformity in Michalopoulos and Papaioannou (2012). We use the same methodology for computing pre-colonial centralization in Uganda as Gennaioli and Rainer (2007), albeit at the district and sub-county level; as elsewhere in Africa we record several stateless societies at level 0 in our Ugandan sample but no highly complex groups at level 4. The district is the highest level of local government; in recent years

the national government has repeatedly created new districts, such that in our analysis below the number of districts varies between 56 and 80 depending on the date the data was collected. (For more on district creation in Uganda see (Green, 2010).) The sub-county is the third-highest level of local government (out of five different levels); in contrast to the ever-increasing number of districts, there has been no increase in the number of sub-counties in recent years.

For Uganda’s major ethnic groups such as the Acholi, Baganda, Basoga, Iteso and Langi – members of which account for over 82% of the current population of Uganda – we can use the Ethnology data directly. However, for most ethnic groups (34 out of the 55 groups listed in the 2002 census) we have to infer the level of pre-colonial complexity by using the attributes of a related group. To do so we used the Ethnologue database to find ethnic groups who speak languages closely related to those listed in the Ugandan census data, as listed in Appendix 1. To calculate the percentage of residents in each local government unit from a centralized ethnic group we used the most recent Ugandan census from 2002, which lists ethnic identity down to the level of the sub-county (Government of Uganda, 2002). As noted above, the detailed nature of this data is unusual for African censuses, and it is also unusual for Ugandan censuses, which have never before listed ethnic data at the sub-county level. We also consider the use of census data to be superior to ethnic data used by Gennaioli and Rainer (2007) and Michalopoulos and Papaioannou (2012), both because their data is from the 1960s but also because census data allows individuals to choose their own identity rather than have it assigned by researchers. Figure 2 displays a map of Uganda with 80 districts shaded five different ways according to the percentage of residents from centralized ethnic groups; the central and south-west region, which comprises the homeland of the traditional Bantu kingdoms of Ankole, Buganda, Bunyoro, Busoga and Toro, is almost entirely dark, while the northern and eastern non-Bantu areas historically home to the Acholi, Itesot, Karamojong and Langi, among others, is largely white.

[Insert Figure 2 here]

### 3 Empirical Analysis

To examine the Gennaioli and Rainer (2007) hypothesis we estimate a basic model using OLS, for the relationship between indicators of pre-colonial centralization and development

$$D_i = \alpha + \beta Centralization_i + \mathbf{X}_i\gamma + \epsilon_i \tag{1}$$

where  $D_i$  is a development indicator for regional unit  $i$ . We perform estimations with three human development indicators popular in the literature: the HDI index (2003 and 2005), Literacy Index (2005) and GDP index (2005).  $Centralization_i$  is an indicator of pre-colonial centralization for regional unit  $i$ , as measured by the percentage of residents in each unit from centralized ethnic

groups,  $\mathbf{X}_i$  is a vector of controls, for regional unit  $i$  and  $\epsilon_i$  is an error term assumed to be normally distributed  $N(0, \sigma_\epsilon^2)$ .

We also use a series of geographical controls to account for geographical determinants of contemporary development outcomes. We control for both elevation (in feet, logged) and average annual rainfall, and we use a dummy to control for whether the district has an international border. Moreover, we control for two types of poor soil content, in both cases via dummy variables. First we control for lithosols, or orthents, which are shallow soils and are thus unsuitable for arable farming, as well as vertisols, which are noted for their high clay content which can only be farmed under a very narrow range of rainfall conditions. More details about all of the variables can be found in Appendix 2.

In Table 1 we present our first set of results: we list the dependent variables in the first column, followed by results without controls and then with controls alongside the number of observations. In Panel A we list district-level results. Our first set of data comes from the 2005 Ugandan Human Development Report (HDR), which calculated a Human Development Index (HDI) for each of Uganda's then 56 districts. The second set of data comes from the 2007 Ugandan HDR, which not only calculated an updated list of HDIs per district – which came to 76 at the time of their analysis – but also their component parts such as indices for literacy and GDP. We were unfortunately unable to match Gennaioli and Rainer (2007)'s analysis for road coverage as data only exists for 20 districts (Government of Uganda, 2010, p. 169); we present our results for schooling, immunization and life expectancy below. Our results are all positive and statistically significant for all four development outcomes.

[Insert Table 1 here]

Panel B of Table 1 reports results with sub-county level data, again compiled by the Ugandan Bureau of Statistics. For this dataset, we have obtained the poverty headcount measure, and a poverty gap measure which calculates the average gap in expenditure necessary for the poor in each region to reach the poverty line, as poverty development indicators. Here we cluster errors at the district level to account for district-level effects.

In both cases in Panel B pre-colonial centralization is both statistically significant and has the correct sign. Moreover, in many regressions without controls pre-colonial centralization explains a great deal of variation in the dependent variable; in the case of the poverty headcount, for instance, it alone explains almost one-third of the variation across 958 sub-counties.

We plot the relationship between centralization and the six dependent variables from Table 1 in Figures 3a-3f; as can be seen there are no serious outliers driving our results. To confirm the lack of outliers we also computed the  $Dfbetas$  from each regression, removed all values where  $Dfbeta > 2/\sqrt{n}$ ; where  $n$  = number of observations (Belsley et al., 1980, p. 28), and reran our regressions, with no differences in our findings (we performed these tests for all regressions reported in Tables 4, 5 and 6 as well with no changes in our results, which are available from authors upon request). We also checked for and eliminated observations with a high Cook's Distance; our results again remained

the same.

[Insert Figure 3 here]

For additional robustness we also test an alternative measure of centralization, where only groups which score 3 are coded as centralized and all others are recorded as decentralized, a change which especially makes a difference in eastern Uganda.<sup>3</sup> The results, which are available from the authors, yield even stronger results than those in Table 1. Finally, we reran our results excluding all districts and sub-counties with less than 20% of their residents from centralized groups, for two reasons. First, as seen in Figure 2 there is a strong divide between northern and eastern Uganda, with almost no residents from centralized groups, and the rest of the country. Thus it is of interest to see if the same results hold when excluding the north and east. Second, our dependent variables were measured during the height of the war involving the Lord's Resistance Army, which only affected northern Uganda, and thus the war could be driving our results as well. However, we found no changes in our results upon excluding the relevant districts and sub-counties (results available upon request).

### 3.1 Survey based empirical estimates

We next turn to results from the Afrobarometer Round 4 survey in Uganda, which in 2008 asked over 2400 respondents a variety of questions relevant to our analysis here. The Afrobarometer is a cross-country survey that first started in 1999 and has now completed 4 rounds across 19 countries in Africa; it measures public attitudes to a variety of social, economic and political phenomena. It is particularly useful to us for several reasons. First, it allows us to work with individual level survey data, thus providing us with an accurate representation of the reach of public policies as well as allowing respondents to freely identify their ethnic groups. Second, it has a very large number of respondents who are well represented across Uganda. Third, it yields a more representative choice of variables with which we can work than the local government data. More specifically, while our previous dependent variables focussed on literacy, human development and income and poverty, the Afrobarometer survey gives us responses on ownership of assets and access to vital necessities, all or some of which are often discussed in the literature as being much more directly related to public expenditures than macro-level variables such as HDI indices, literacy indices and income and poverty levels. For our principle explanatory variable, pre-colonial centralization, we use the individuals' response on his/her ethnic identity to create a dummy variable which captures whether or not the respondent's ethnic group was centralized or not. The dataset also provides us with variety of socio-economic variables which we use as controls, such as age, age squared, a dummy for gender and household head and sub-county ELF. For our dependent variable, we use responses to questions on access to vital necessities in the past year: namely, food, water, medical care, cooking fuel and cash income. Responses to the question ranges from never (coded as 0) to always (coded 4).

The model we estimate is given by the following equation 2, and we use ordered logit regressions to estimate it.



$$C_i = \delta + \theta \text{CentralizationDummy}_i + \mathbf{X}_i \lambda + \varepsilon_i \quad (2)$$

where  $C_i$  corresponds to response to question "Gone without \_\_ in past year" (0-4, with 0 = never and 4 = always) for individual  $i$ . We perform estimations with responses on food, water, medical care, cooking fuel and cash income.  $\text{CentralizationDummy}_i$  is a dummy which captures whether or not the respondent's ethnic group was centralized or not,  $\mathbf{X}_i$  is a vector of controls, for individual  $i$  and  $\varepsilon_i$  is an error term assumed to be normally distributed  $N(0, \sigma_\varepsilon^2)$ . Panel A of Table 2 presents ordered logit estimates estimates of the equation 2.

In Panel B of Table 2 we present estimates of logit regressions of a similar relationship of pre-colonial centralization with the ownership of assets such as a radio, television and a car or motorcycle. We estimate the following model:

$$A_i = \mu + \rho \text{CentralizationDummy}_i + \mathbf{X}_i \psi + \varepsilon_i \quad (3)$$

where  $A_i$  corresponds to response to question "Personally own a \_\_\_" (0 = no and 1 = yes) for individual  $i$ .  $\mathbf{X}_i$  is a vector of controls (the same controls used as for estimating model 2), for individual  $i$  and  $\varepsilon_i$  is an error term assumed to be normally distributed  $N(0, \sigma_\varepsilon^2)$ .

In all cases we cluster the standard errors at the sub-county level, with our results robust to clustering at alternative levels of local government as well. Our results are unequivocal: all of the coefficients of the centralization variable have the correct sign (i.e. positive) and are statistically significant at the 5% level with the sole exception of car or motorcycle ownership, which is significant at the 10% level.

[Insert Table 2 here]

## 4 Instrumental Variable Regressions

As noted above, one issue with Gennaioli and Rainer (2007) is that they do not deal with the potential problem of reverse causality between pre-colonial centralization and the development outcome variables using an instrumental variable analysis. More specifically, it is possible that pre-colonial economic development led both to the emergence of pre-colonial states and to the persistence of economic development outcomes to the present day. Of course, finding an instrument for pre-colonial centralization at the country-level is extremely difficult given the complex pre-colonial history of Africa. However, the use of the Ugandan case study here simplifies the search for such an instrument given the large literature on pre-colonial state formation in Uganda.

Here we employ the log of distance from Mubende town as an instrument for pre-colonial political complexity. Mubende town, in what is now Mubende district, was the legendary capital of the medieval Bacwezi empire established by king Ndahura, who supposedly "conquered lands in various

directions” from his capital (Chrétien, 2003, p. 97). While much of the history of the Bacwezi is shrouded in uncertainty, recent archeological evidence suggests a significant human presence at Mubende between 1275 and 1400 (Robertshaw & Taylor, 2000, p. 16).<sup>4</sup> Moreover, historians are much more certain about the pre-colonial history of the kingdom of Bunyoro, whose capital was established at Mubende at one point and which spawned the other neighboring kingdoms of southern and western Uganda over subsequent centuries (Chrétien, 2003, p. 103; Oliver, 1955, p. 115).

We plot the relationship between the log of distance and pre-colonial centralization for 79 districts in Figure 3; due to the fact that we are forced to drop Mubende district the number of observations decreases by one in relation to Table 1. As is clear the relationship is not driven by any outliers and distance from Mubende explains a majority of the variation in pre-colonial centralization. In Table 4 we regress pre-colonial centralization on distance from Mubende for the two datasets of districts and the sub-counties alongside four other geographical controls, namely elevation, rainfall and poor soil as measured by lithosol and vertisol dummy variables. Distance from Mubende is negative, statistically strongly significant, with p-values lower than 0.001 for all three regressions; vertisols and lithosols are also strongly and weakly significant, respectively, both in the expected direction.<sup>5</sup> Finally, the F-statistic in all three regressions is high, suggesting that distance from Mubende is a strong instrument.

[Insert Figure 4 and Table 3 here]

As with any instrumental variable, the question arises as to whether distance from Mubende has influenced contemporary developmental outcomes via channels other than pre-colonial centralization. For instance, it is plausible that the areas near Mubende where centralized polities were established in the pre-colonial period had better climatic conditions for agriculture and thus had higher levels of development which have persisted to the present day. However, the controls for soil, rainfall and elevation in Table 4 fail to remove the statistical significance of the variable measuring distance from Mubende. Moreover, historical evidence suggests that the center of power for Bunyoro had shifted northwards from Mubende far before independence. From the late 18th to the mid 19th-century its capitals were located in what is now Kibaale district (Nyakatura, 1973, pp. 88, 92, 98), while its late-19th century capitals were in what are now Hoima and Masindi districts (Doyle, 2006, p. 39). The colonial period saw the establishment of the capitals of Bunyoro in the towns of Hoima (1900-1912 and 1924-present) and Masindi (1912-1924), while the new railway system which was constructed from Kasese in western Uganda all the way to Nairobi and the Indian Ocean coast bypassed Mubende (as can be seen in Figure 1). The result is that Mubende today remains a relative backwater town in one of the poorer parts of Buganda kingdom, suggesting that proximity to Mubende does not have any direct effect on contemporary developmental outcomes.

We now estimate equation 2 as the second stage regression and present our second stage results in Table 4, with the dependent variables now listed separately in every column instead of in every row as in Tables 1 and 2. The results are just as strong as in Table 1; the coefficient for centralization is higher for the results at the district level but are almost the same for the sub-county dataset.

[Insert Table 4 here]

## 5 Testing mechanisms

Gennaioli and Rainer (2007) propose three competing hypotheses for the relationship between pre-colonial centralization and contemporary development. First, areas which were already developed in the pre-colonial period have remained more developed to the present day, a mechanism which they call the ‘advancement’ hypothesis. Second, it could be that centralized ethnic groups have more legitimate local chiefs and that these chiefs thereby have both better incentives and better abilities to implement modernization programs. Third, the relationship could be driven by national-level mechanisms, whereby centralized ethnic groups improve national level development patterns. Since we are attempting to explain within-country differences we can obviously eliminate the third hypothesis, which leaves us with the first two hypotheses.

Gennaioli and Rainer (2007) propose that the second mechanism, which they call the ‘local accountability’ hypothesis, is correct. They do so by splitting each country’s population along a 2 x 2 matrix of two binary variables, namely centralization and class stratification, with the latter variable also taken from Murdock (1967). They then designate various types of public goods as characterized by high levels of geographic spillover (education and infant mortality), such that local chiefs are forced to cooperate, and low levels of spillover (paved roads and immunization), which instead has little influence outside the community in question. As such Gennaioli and Rainer (2007) predict that for low spillover goods the benefits of pre-colonial centralization will be higher for more stratified groups, since such groups would have particularly poor public goods provision due to class divisions. In converse, however, for high spillover goods the effect of pre-colonial centralization should be uniform across stratified and egalitarian groups. Their cross-national results appear to confirm these hypotheses.

On the one hand, data limitations prevent us from undertaking the same exercise here, as data on stratification is missing for various major ethnic groups while inferring data from related groups is more difficult with stratification as it does not correspond to linguistic differences in the same way as centralization. Gennaioli and Rainer (2007) also test for a variety of other measurements of pre-colonial advancement for which there is no subnational data available for Uganda or there is little to no variation at the subnational level, such as being landlocked or nomadic. However, on the other hand we have a variety of other data which allows us to test for mechanisms here, both at the district and the individual levels. If the ‘advancement’ mechanism is correct then its effects should be obvious at the individual level and not just the local government level; moreover, if true it implies that individuals from centralized ethnic groups should be richer than those from decentralized ethnic groups but that these differences should not necessarily be obvious at the level of public goods. If instead it is the ‘local accountability’ hypothesis that is correct, we should instead see a set of

correlations between centralization and public goods outcomes. Inasmuch as the ‘local accountability’ hypothesis relies on the higher levels of legitimacy for local governments in more centralized areas, we should also observe higher levels of local government performance in more centralized areas.

We first test these two hypotheses with a variety of data on public goods provision at the district level in Table 5. Our first two dependent variables are the other two measures included in the UNDP 2007 district HDI measurements, namely gross primary school enrollment and a life expectancy index. In both cases the data is not strictly the same as those used by (Gennaioli & Rainer, 2007) but nonetheless functions as a good proxy for measuring the quality of education and health in each district, respectively.<sup>6</sup> We then use the most recent government data on access to safe drinking water (in 2008) and the percentage of district health posts that were actually filled (in 2009). Finally, we use a number of different measures from the most recent Ugandan Statistical Yearbook (Government of Uganda, 2010). We first measure the total number of health centers per 10,000 inhabitants as well as the average level of coverage between 2007 and 2009 for four different types of immunization: BCG (against tuberculosis), DPT (against diphtheria, pertussis and tetanus), Measles, and Oral Polio Vaccines. Finally, we use data on four different indicators for primary education, namely gross intake rate, net intake rate, gross enrolment rate and net enrolment rate. (See Appendix 2 for more details on the differences between these variables.) As with immunization, in all four cases we take the average level between 2007 and 2009.

The model estimated is given by:

$$G_i = \mu + \psi CentralizationDummy_i + \mathbf{H}_i v + \omega_i \quad (4)$$

where  $G_i$  is the development outcome variable, either an education, life expectancy or health outcome.  $\mathbf{H}_i$  is a vector of controls for regional unit  $i$  and  $\omega_i$  is an error term assumed to be normally distributed  $N(0, \sigma_\omega^2)$ . Equation 4 is estimated using OLS.

[Insert Table 5 here]

Our results, as reported in Table 5, show a striking lack of correlation between pre-colonial centralization and these eleven variables measuring education and health outcomes. Indeed, with three of the four immunization variables we observe a negative relationship between centralization and public goods provision, although this result is not robust to dropping soil types as control variables.

Of course, the lack of any relationship between centralization and these education and health outcomes could be the result of central government decisions rather than local government policies. However, education and health spending in Uganda have been decentralized since the early 1990s, whereby district and sub-county governments receive 35% and 42% of all locally-generated revenue, respectively (Francis & James, 2003, p. 328). Moreover, the central government sends money to local governments in the form of conditional, unconditional and equalization grants, which in the last case are for districts which are behind the national average for a particular public service. For

example, in one noted study scholars found that not only was local government spending on nonwage education expenditures a fraction of the actual grant sent by the central government but it varied significantly across regions, suggesting a strong degree of local autonomy over education spending (Reinikka & Svensson, 2004).

If, according to the local accountability hypothesis, there should be a positive correlation between centralization and local government accountability and performance, then we should be able to observe this relationship using Afrobarometer data. The Afrobarometer records information on citizens' trust in local government, the degree to which citizens feel that local government councilors listen to them, and the performance of local governments in handling the following: maintaining roads, maintaining market places, maintaining food standards at restaurants and food stalls, keeping the council clean, collecting license fees and property taxes, making their work known to citizens, providing information about their budgets, allowing citizens to participate in decision-making, consulting others, handling complaints and using government revenues well. We estimate model 4 using ordered logit regressions, with Afrobarometer variables on service provision as our dependent variables.

In our analysis the independent variable of interest is not, however, a centralization dummy based on each individual's ethnic identity but rather the percentage of people in each sub-county from centralized ethnic groups, as in Tables 1 and 4. In all cases we use the same set of control variables as in Table 2 and cluster errors at the sub-county level. The results, which can be found in Table 6, demonstrate a total lack of correlation between sub-county pre-colonial centralization and perceptions of local government performance, which in most cases results in a negative (albeit non-significant) relationship.

[Insert Table 6 here]

One response to this set of results would be to refer back to the correlation between literacy and pre-colonial centralization presented in Table 1. The two variables are highly correlated at the district level (0.73), as they are at the national level, which has led to a series of criticisms of the HDI going back to its inception (cf. McGillivray, 1991, and more recently Høyland et al., 2011). Likewise, the positive and significant relationship between literacy and development outcomes are also not indicative of education as a successful public good, particularly in developing countries, where education is largely not a public good. Indeed, while education is more of a public good in developed countries (such as the United States and the United Kingdom and elsewhere in Europe), there is a great deal of evidence in the economics literature that even publicly delivered private goods are also not fully "public" in their remit as they are dependent upon the public delivery institutions which often fail demonstrably in poor countries (Besley and Ghatak 2010). In particular evidence from Uganda suggests that despite the abolition of school fees households still have to cover indirect private costs such as meals, uniforms and transportation (Nishimura et al., 2008).

Finally, our results here could be the result of a clash between traditional authorities from centralized ethnic groups and contemporary local government officials. More specifically, it could be that local accountability explained a divergence in public goods provisions across Uganda in pre-

vious decades when traditional authorities held control over local government administration, but that this link was broken when Milton Obote abolished the political role of Uganda's kingdoms in the 1960s. Indeed, after the kingdoms were restored under President Museveni's government in 1993 they have clashed with the central government on such issues as land ownership. However, there is little evidence that the kingdoms have attempted to stymie the provision of local public goods; if anything, the Kabaka (king) of Buganda and other kingdom leaders have explicitly encouraged their subjects to attend school and get immunized (Nasamula, 2012).

To sum up this section, the set of results presented in Table 5 show a striking lack of correlation between pre-colonial centralization and public goods in education and health, while in Table 6 the results showed a lack of correlation between pre-colonial centralization and local government accountability and performance. These results contrast strong with the results presented in Tables 1-2 and Table 4, which clearly showed a strong relationship between pre-colonial centralization and such measurements as GDP, poverty and asset ownership. These dual set of results clearly suggest that pre-colonial centralization is correlated with contemporary access to private goods rather than public goods.

## 6 Conclusions

In this paper we tested Gennaioli and Rainer (2007)'s hypothesis that pre-colonial political centralization is a determinant of post-colonial African development by using the case of Uganda. Employing a wide variety of evidence from the UN, Afrobarometer, and Ugandan Government, we showed that pre-colonial centralization is indeed highly correlated with contemporary measurements of GDP, poverty and asset ownership, a result which is robust to the use of various control variables and distance from the ancient capital of Mubende as an instrumental variable. However, we also showed that pre-colonial centralization is neither correlated with public goods provision in the case of health and education nor with local government accountability or efficacy.

Our results therefore suggest a correlation between pre-colonial centralization and private rather than public goods, leading us to propose that levels of wealth have persisted in Uganda from the pre-colonial period to the present day. Indeed, the qualitative historical record supports this conclusion in three ways. In the first case we can document a positive effect of pre-colonial states on local welfare. States like Buganda and Bunyoro were not only centers of wealth but had the ability to use this wealth to feed the poor in times of famine (Doyle, 2006, p. 31). Nor is pre-colonial Uganda unique in this regard: as noted by McCaskie (2003, p. 31), pre-colonial states like the Asante in West Africa 'cannot be remotely classified as an economy of generalized want and hunger.' Secondly, there is recent evidence that pre-colonial centralization is actually negatively correlated with contemporary levels of democracy outside Europe, whereby the spread of colonial institutions was hindered by strong pre-colonial states (Hariri, 2012). In other words, pre-colonial centralization appears to be

correlated with lower rather than higher levels of political accountability, at least at the country level.

Third and finally, people in centralized pre-colonial states were generally better off than stateless peoples due to the effects of states in promoting underdevelopment among stateless peoples, particularly through slave-raiding. The effects of the inter-continental slave trade on African underdevelopment have already been explored by Nunn (2008), who finds a robust relationship between the number of slaves exported and contemporary GDP per capita; Nunn and Wantchekon (2011) suggest that the relevant mechanism was the way in which slavery led to greater levels of mistrust within Africa. Indeed, in pre-colonial Sub-Saharan Africa land was abundant but labor scarce in the pre-colonial era, which meant that poverty at the time was more defined by a lack of access to labor than to land (Iliffe, 1987). Slave-raiding was therefore the ideal way to alleviate labor shortages, especially by raiding neighboring groups: ‘it is inaccurate to think that Africans enslaved their brothers – although this sometimes happened. Rather, Africans enslaved their enemies’ (Lovejoy, 2000, p. 22). Thus the Bunyoro state would often raid for slaves among the Alur of north-west Uganda (Doyle, 2006, p. 37), while neighboring Acholi, Lugbara and Madi people were similarly targeted by Arabic slave traders from what is now Sudan (Leopold, 2006, pp. 181-185).<sup>7</sup> The effect of such raids was not only to negatively affect those who became slaves but also those left behind where labor was even more scarce than it had been before, thereby only exacerbating pre-colonial inequalities between centralized and stateless peoples.<sup>8</sup> The nature of the impact of pre-colonial slavery within Africa on post-colonial development - as opposed to the effects of the inter-continental slave trade - remains, however, a topic for further discussion.

As regards Gennaioli and Rainer (2007), our results support their findings but not their proposed mechanism about the quality of local government in centralized areas. In suggesting the persistence of poverty from the pre-colonial period to the present we thereby argue against the noted ‘Reversal of Fortune’ thesis proposed by Acemoglu, Johnson and Robinson (2002), whereby colonialism made poorer areas rich and turned richer areas poor. Our results instead match with those of Bandyopadhyay and Green (2012), who argue that this Reversal did not take place within Africa, alongside those of Hjort (2010) and others who suggest that pre-colonial social formations have persistent effects on contemporary development.

Moreover, our results also add to a growing literature on the specific impact of pre-colonial political centralization on subsequent economic and political development. For instance, Gerring, Ziblatt, Van Gorp and Arévalo (2011) show that pre-colonial centralization is positively and robustly correlated with indirect colonial rule, which suggests that much of the impact of colonialism on contemporary development may in fact be attributable to the influence of pre-colonial development instead. Similarly, Bockstette, Chanda and Putterman (2002) suggest that a history of a state over the past 2000 years is highly correlated at the cross-national level with contemporary measures of political stability and economic development.

We hope this analysis has contributed toward the growing literature on the role of history in

contemporary African development. Further work on this subject could investigate the same relationships in another context, whether in another African country or somewhere else with similarly large variation in pre-colonial centralization. Indeed, examining the relationship between pre-colonial centralization and contemporary development across different colonies might add significantly to our growing knowledge about varieties of colonialism, both in terms of different colonizer but also as regards local variation in the colonies themselves.

## Notes

<sup>1</sup>Morning (2008) finds that only 44% of African countries ask questions about ethnicity on their censuses, tied with Europe for the lowest proportion among all regions in the world. Some countries like Tanzania have not asked questions about ethnicity since the 1960s.

<sup>2</sup>This problem of decreasing levels of centralization across space assumes that the mechanism is transferred across time via territory irregardless of who now lives in the relevant geographical unit. If instead it is transferred inter-generationally within members of centralized ethnic groups then Michalopoulos and Papaioannou (2012)'s model assumes that each homeland is ethnically homogenous, a highly problematic assumption.

<sup>3</sup>We cannot, however, perform the exercise using a score of 1 as the threshold, since it only yields six districts with less than half of their residents from centralized ethnic groups.

<sup>4</sup>Robertshaw and Taylor (2000) also discuss evidence of an earlier settlement at Ntusi, some 65km south-west of Mubende in what it is now the neighboring district of Sembabule; while there is no legend attaching Ntusi to the growth of the region's subsequent kingdoms, the evidence nonetheless does suggest the existence of a centralized chiefdom some two hundred years earlier than at Mubende. If we use an instrument measuring distance from Ntusi rather than from Mubende we obtain essentially the same results as reported here (results available from authors).

<sup>5</sup>We do not include vertisol and lithosol as instruments since bivariate regressions show that they explain much smaller percentages of the variation in complexity than distance from Mubende; nonetheless, our results are robust to the use of both soil types as additional instruments (results available from authors).

<sup>6</sup>Incidentally, Gennaioli and Rainer (2007, p. 193) note that their results are nearly identical if they substitute life expectancy for infant mortality

<sup>7</sup>Michalopoulos and Papaioannou (2012) attempt to control for this possibility by introducing a dummy variable measuring the existence/non-existence of slavery within each ethnic group; they find no statistical relationship between this slavery variable and light intensity. However, the existence of slavery was not necessarily correlated with slave raiding; thus the Alur and Lugbara, to take two examples, are both recorded by Murdock (1967) as using slaves yet suffered from slave-raiding much more than they gained.

<sup>8</sup>For evidence outside Africa see Scott (2009), who suggests that stateless peoples in south-east Asia deliberately refused to adopt writing in order to frustrate state attempts at capturing and classifying them; being pre-literate (or post-literate as Scott (2009) calls them) would have also inhibited economic development in obvious ways.

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**Table 1: Pre-Colonial Centralization and Development in Uganda**

Sources: (Emwanu, Okwi, Hoogeveen, Kristjanson, &amp; Henninger, 2007; UNDP, 2005, 2007)

Dependent Variable	Pre-Colonial Centralization (w/o controls)	R <sup>2</sup>	Pre-Colonial Centralization (with controls)	R <sup>2</sup>	Number of Local Government Units
<i>Panel A: District-Level Data</i>					
HDI (2003)	0.101*** (0.022)	0.311	0.073*** (0.019)	0.489	55
HDI (2005)	0.086*** (0.021)	0.186	0.079*** (0.023)	0.435	76
Literacy Index (2005)	0.202*** (0.042)	0.251	0.195*** (0.049)	0.432	76
GDP Index (2005)	0.108*** (0.016)	0.396	0.275*** (0.327)	0.466	76
<i>Panel B: Sub-County-Level Data (from 2002)</i>					
Poverty Headcount	-26.092*** (4.197)	0.317	-20.088*** (3.805)	0.398	958
Poverty Gap	-12.630*** (2.219)	0.297	-9.510*** (1.772)	0.388	956

\*  $p \leq 0.1$ , \*\*  $p \leq 0.05$ , \*\*\*  $p \leq 0.01$ ; robust standard errors in parentheses. The table reports OLS estimates. For Panel A controls include log of elevation, ethno-linguistic fractionalization, rainfall and dummies for poor soils (lithosol and vertisol) and international borders; for Panel B we cluster standard errors at the district while our controls include ethno-linguistic fractionalization, dummies for poor soils (lithosol and vertisol) and international borders.

**Table 2: Pre-Colonial Centralization and Development in Uganda, Afrobarometer Survey Data**

Dependent Variable	Pre-Colonial Centralization Dummy	Controls	Observations	Sub-County Clusters	Pseudo R <sup>2</sup>
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*Panel A: Ordered Logit Regressions*

Gone without \_\_\_\_ in the past year (0-4, with 0 = never and 4 = always)

Food	-1.271*** (0.134)	Yes	2410	168	0.062
Water	-0.757*** (0.126)	Yes	2415	168	0.020
Medical Care	-0.565*** (0.135)	Yes	2413	168	0.015
Cooking Fuel	-0.770*** (0.126)	Yes	2412	168	0.015
Cash Income	-0.388*** (0.121)	Yes	2410	168	0.023

*Panel B: Logit Regressions*

Personally own a \_\_\_\_ (0 = No, 1 = Yes)

Radio	0.341*** (0.132)	Yes	2416	168	0.048
Television	0.602** (0.241)	Yes	2416	168	0.076
Car or Motorcycle	0.374* (0.195)	Yes	2416	168	0.053

\*  $p \leq 0.1$ , \*\*  $p \leq 0.05$ , \*\*\*  $p \leq 0.01$ ; robust standard errors clustered at the sub-county level in parentheses. Controls include age, age squared, gender, head of household dummy, and sub-county ethno-linguistic fractionalization.

**Table 3: Determinants of Pre-Colonial Centralization in Uganda**

	(1)	(2)	(3)
Mubende Distance (log)	-0.414*** (0.077)	-0.486*** (0.068)	-0.432*** (0.026)
Lithosol	-0.123* (0.067)	-0.108* (0.059)	-0.135*** (0.034)
Vertisol	-0.255*** (0.074)	-0.170** (0.069)	-0.179*** (0.025)
Elevation (log)	0.343 (0.235)	0.208 (0.186)	
Rainfall	-0.035 (0.030)	-0.033 (0.022)	
N	54	75	957
R <sup>2</sup>	0.614	0.556	0.423
F-statistic	14.56	36.28	167.71
Prob > F	0.000	0.000	0.000

\*  $p \leq 0.1$ , \*\*  $p \leq 0.05$ , \*\*\*  $p \leq 0.01$ ; robust standard errors in parentheses. The table reports OLS estimates.

**Table 4: Instrumental Variable Results**  
Sources: (Emwanu, et al., 2007; UNDP, 2005, 2007)

*Panel A: District Results*

	HDI (2004)	HDI (2007)	Literacy (2007)	GDP (2007)
Pre-Colonial Centralization	0.220*** (0.080)	0.162*** (0.050)	0.535*** (0.108)	0.190*** (0.037)
Controls	yes	yes	yes	yes
N	54	75	75	75

*Panel B: Sub-County Results*

	Poverty Headcount	Poverty Gap
Pre-Colonial Centralization	-26.472*** (6.373)	-14.279*** (3.245)
Controls	yes	yes
N	957	955

\*  $p \leq 0.1$ , \*\*  $p \leq 0.05$ , \*\*\*  $p \leq 0.01$ ; robust standard errors in parentheses. The table reports 2SLS estimates with log of distance from Mubende as an instrument for pre-colonial centralization. For Panel A controls include log of elevation, ethno-linguistic fractionalization, rainfall and dummies for poor soils (lithosol and vertisol) and international borders; for Panel B we cluster standard errors at the district while our controls include ethno-linguistic fractionalization and dummies for poor soils (lithosol and vertisol) and international borders.



**Table 5: Pre-Colonial Centralization and Public Goods in Uganda**

Sources: (Government of Uganda, 2008, 2009, 2010; UNDP, 2007)

Dependent Variable	Pre-Colonial Centralization	Controls	R <sup>2</sup>	Number of Districts
Gross Enrollment Index (2005)	-0.009 (0.103)	yes	0.284	76
Life Expectancy Index (2005)	0.016 (0.037)	yes	0.305	76
Access to Safe Drinking Water	-0.047 (0.068)	yes	0.157	76
Percentage of District Health Posts Filled	-0.093 (0.060)	yes	0.146	80
Health Centers per 10,000 inhabitants	0.079 (0.267)	yes	0.078	80
BCG Immunization	-0.850 (6.403)	yes	0.238	80
DPT Immunization	-13.017* (7.277)	yes	0.160	80
Measles Immunization	-17.176** (7.499)	yes	0.224	80
Oral Polio Vaccine	-12.600* (6.926)	yes	0.214	80
Gross Intake Rate	-13.747 (18.539)	yes	0.152	80
Net Intake Rate	4.370 (6.649)	yes	0.073	80
Gross Enrolment Rate	-9.567 (11.975)	yes	0.189	80
Net Enrolment Rate	-5.203 (8.679)	yes	0.133	80

\*  $p \leq 0.1$ , \*\*  $p \leq 0.05$ , \*\*\*  $p \leq 0.01$ ; robust standard errors in parentheses. The table reports OLS estimates. Controls include log of elevation, ethno-linguistic fractionalization, rainfall and dummies for poor soils (lithosol and vertisol) and international borders. Data for the dependent variable is from (UNDP, 2007) for the first two rows, (Government of Uganda, 2008) for the third row, (Government of Uganda, 2009) for the fourth row and (Government of Uganda, 2010) for the rest of the table. The last eight rows are all based on the average measurement between 2007 and 2009.

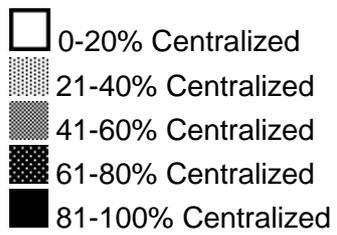
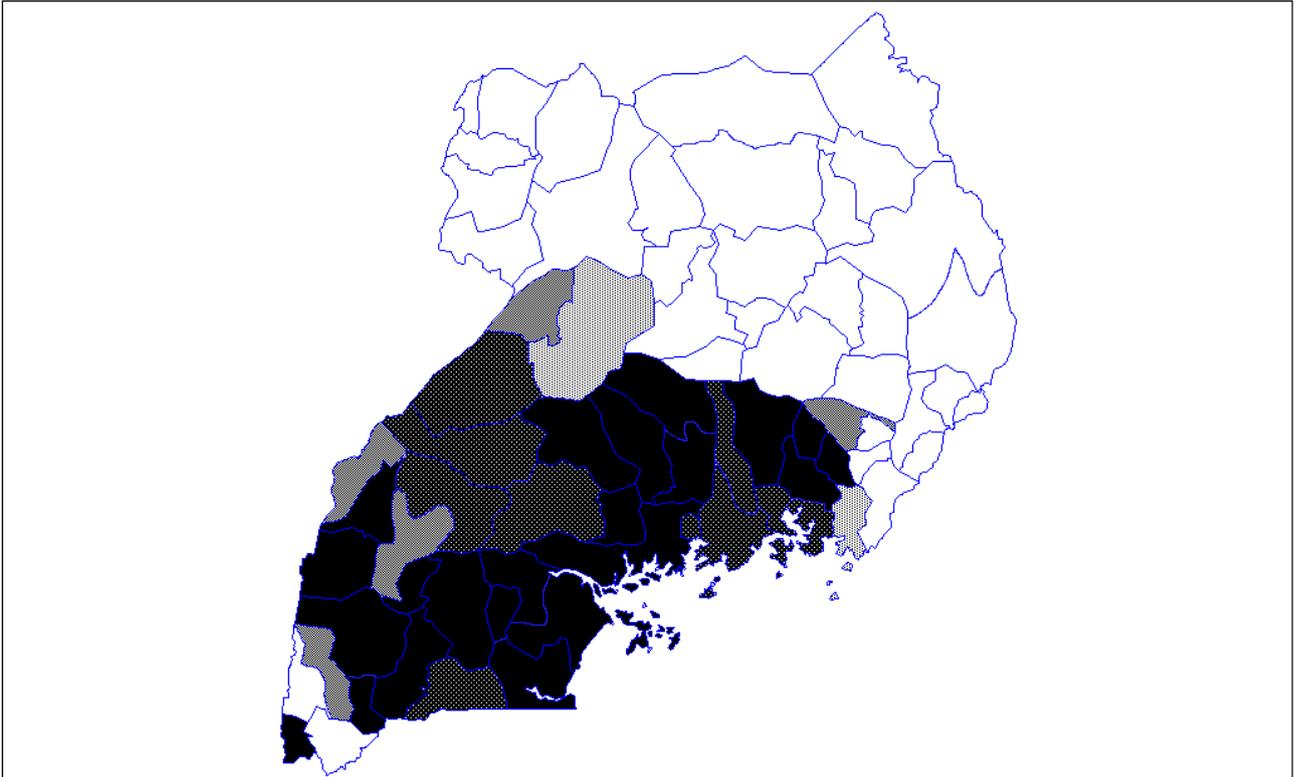
**Table 6: Pre-Colonial Centralization and Development in Uganda,  
Afrobarometer Survey Data**

Dependent Variable	Pre-Colonial Centralization Percentage	Controls	Observations	Sub- County Clusters	(Pseudo) R <sup>2</sup>
Trust in local government (0-3; 0 = none, 3 = a lot)	0.014 (0.183)	yes	2356	168	0.005
LG Councilors listen to people like me (0-3; 0 = none, 3 = a lot)	-0.125 (0.194)	yes	2368	168	0.005
How does the local government handle the following (1-4; 1 = very badly, 4 = very well)					
Maintains local roads	0.054 (0.221)	yes	2403	168	0.002
Maintains market places	-0.184 (0.196)	yes	2343	168	0.002
Maintains food health standards	-0.272 (0.179)	yes	2318	168	0.004
Keeps council clean	-0.155 (0.167)	yes	2348	168	0.002
Collects license fees	0.194 (0.195)	yes	1803	168	0.004
Collects property tax	0.099 (0.180)	yes	1623	168	0.002
Makes work known to ordinary people	-0.317* (0.189)	yes	2219	168	0.006
Provides information about budgets	-0.452** (0.182)	yes	2200	168	0.008
Allows citizens to participate in decisions	-0.123 (0.190)	yes	2245	168	0.004
Consults others	-0.339* (0.197)	yes	2101	168	0.006
Handles complaints	-0.319 (0.203)	yes	2130	168	0.002
Uses government revenues well	-0.154 (0.207)	yes	2095	168	0.004

\*  $p \leq 0.1$ , \*\*  $p \leq 0.05$ , \*\*\*  $p \leq 0.01$ ; robust standard errors clustered at the sub-county level in parentheses. The table reports ordered logit estimates. Controls include age, age squared, gender, head of household dummy, and sub-county ethno-linguistic fractionalization.



**Figure 2: District-Level Map of Uganda**



Figures 3a-3f: Political Centralization and Development Outcomes (from Table 1)

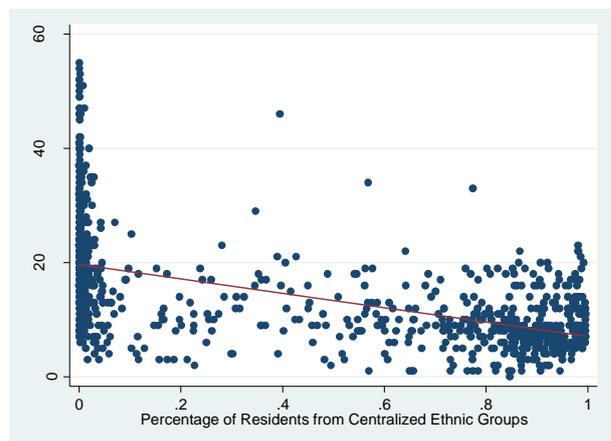
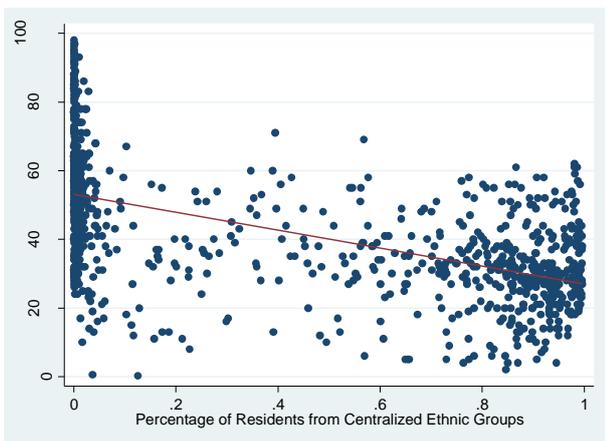
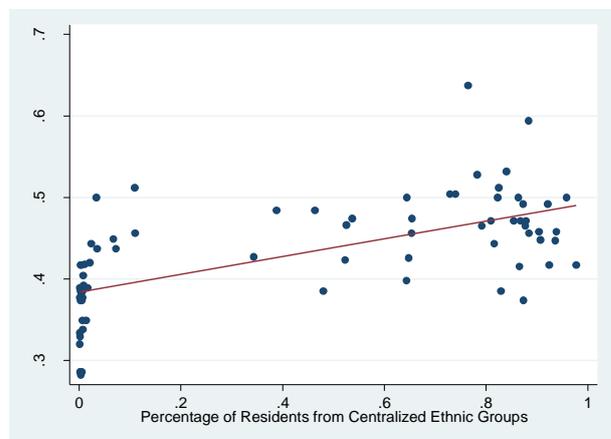
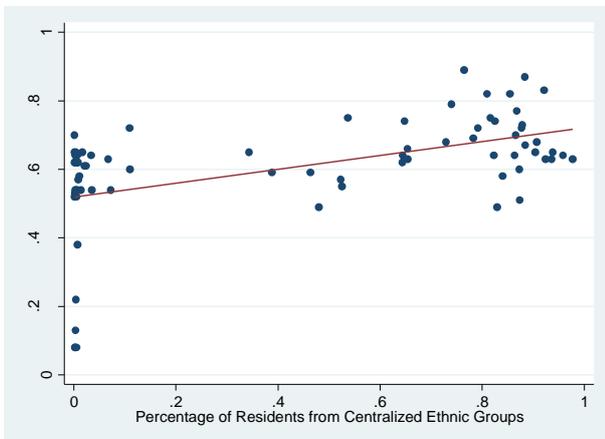
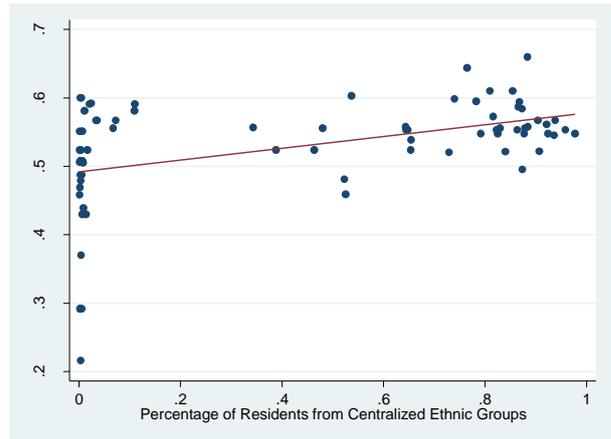
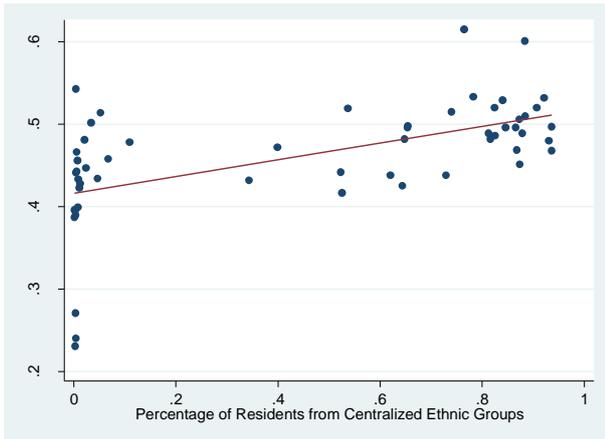
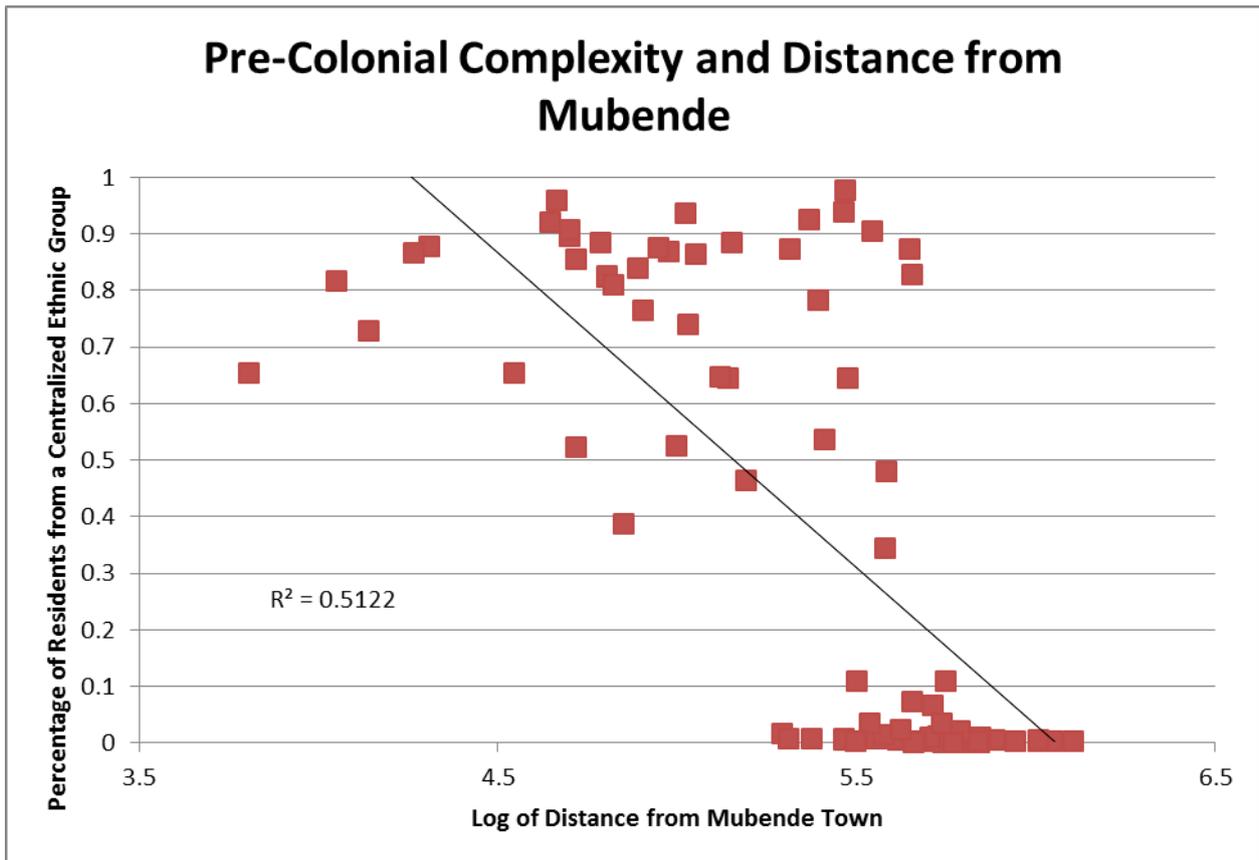


Figure 4: Log of Distance from Mubende and Pre-Colonial Centralization



### Appendix 1: Ethnic Groups and Pre-Colonial Centralization

Ethnic Group	Centralization	Similar Ethnic Group	Ethnic Group	Centralization	Similar Ethnic Group
Acholi	1		Batuku	3	Batoro
Alur	1		Batwa	0	Mbuti (in the DRC)
Aringa	1	Acholi/Iteso/Kakwa	Chope	1	Acholi/Iteso/Kakwa
Baamba	0		Dodoth	1	Jie
Babukusu	1	Tiriki (Luhya; in Kenya)	Ethur	1	Jie
Babwisi	0	Baamba	Ik (Teuso)	1	Acholi/Iteso/Kakwa
Bafumbira	3	Banyarwanda	Iteso	1	
Baganda	3		Jie	1	
Bagisu	1		Jopadhola	1	Acholi/Iteso/Kakwa
Bagungu	3	Banyoro/Batoro	Kumam	1	Acholi/Iteso/Kakwa
Bagwe	1	Tiriki (Luhya; in Kenya)	Jonam	1	Acholi/Iteso/Kakwa
Bagwere	2	Basoga	Kakwa	1	
Bahehe	2		Karimojong	1	Jie
Bahororo	3	Banyankole	Kebu(okebu)	1	Acholi/Iteso/Kakwa
Bakenyi	2	Basoga	Kuku	1	
Bakhonzo	0		Kumam	1	Acholi/Iteso/Kakwa
Bakiga	0		Langi	0	
Banyankole	3		Lendu	1	Acholi/Iteso/Kakwa
Banyara	3	Baganda/Banyoro	Lugbara	1	
Banyarwanda	3		Madi	1	
Banyole	1	Tiriki (Luhya; in Kenya)	Mening	1	Iteso
Banyoro	3		Mvuba	1	Acholi/Iteso/Kakwa
Baruli	3	Baganda/Banyoro	Napore	1	Acholi/Iteso/Kakwa
Basamia	1	Tiriki (Luhya; in Kenya)	Nubi	1	Dinka (in Sudan)/Kakwa/Lugbara
Basoga	2		Nyangia	1	Acholi/Iteso/Kakwa
Basongora	0	Baamba	Pokot	1	Acholi/Iteso/Kakwa
Batagwenda	3	Banyankole/Batoro	Sabiny/Sebei	1	
Batoro	3		So/Tepeth/Topotha	1	

## Appendix 2: Data Sources

### Dependent Variables

*Access to Safe Drinking Water:* Access to safe drinking water in 2008. Source: (Government of Uganda, 2008).

*BCG Immunization:* Average coverage of BCG (tuberculosis) immunization between 2007 and 2009. Source: (Government of Uganda, 2010).

*DPT Immunization:* Average coverage of DPT (diphtheria, pertussis and tetanus) immunization between 2007 and 2009. Source: (Government of Uganda, 2010).

*GDP Index:* GDP per capita Index for 2005. Source: (UNDP, 2007).

*HDI2003:* Human Development Index for 2003. Source: (UNDP, 2005).

*HDI2005:* Human Development Index for 2005. Source: (UNDP, 2007).

*Gross Enrollment Index:* Index of the ratio of all pupils enrolled in primary school to the total population of six- to twelve year olds in the district for 2005. Source: (UNDP, 2007).

*Gross Enrollment Ratio:* the average ratio of all pupils enrolled in primary school to the total population of six- to twelve year olds in the district between 2007 and 2009. Source: (Government of Uganda, 2010).

*Gross Intake Ratio:* the average ratio of all pupils enrolled in primary grade one to the total population of six-year olds per district between 2007 and 2009. Source: (Government of Uganda, 2010).

*Health Centres per 10,000 inhabitants:* total number of health centres per 10,000 inhabitants. Source: (Government of Uganda, 2010).

*Inequality:* Gini index of inequality, ranging from 0 (perfect equality) to 1 (perfect inequality). Source: (Emwanu, et al., 2007).

*Life Expectancy Index:* Average Life Expectancy Index for 2005. Source: (UNDP, 2007).

*Literacy Index:* Adult Literacy Index for 2005. Source: (UNDP, 2007).

*Measles Immunization:* Average coverage of measles immunization between 2007 and 2009. Source: (Government of Uganda, 2010).

*Net Enrollment Ratio:* the average ratio of pupils enrolled in primary school aged 6-12 to the total population of six- to twelve year olds in the district between 2007 and 2009. Source: (Government of Uganda, 2010).

*Net Intake Ratio:* the average ratio of pupils aged six enrolled in primary grade one to the total population of six-year olds per district between 2007 and 2009. Source: (Government of Uganda, 2010).

*Oral Polio Vaccine:* Average coverage of oral polio vaccine between 2007 and 2009. Source: (Government of Uganda, 2010).

*Percentage of District Health Posts Filled:* percentage of district health posts filled (actual number divided by the norm) in 2009. Source: (Government of Uganda, 2009).



*Poverty Gap*: Average gap in expenditure necessary for the poor to reach the poverty line. Source: (Emwanu, et al., 2007).

*Poverty Headcount*: Percentage of residents under the poverty line. Source: (Emwanu, et al., 2007).

### Independent Variables

*Border*: Dummy variable which takes the value of 1 in districts which have an international border and 0 otherwise. Source: computed by authors.

*Pre-Colonial Centralization Dummy*: Dummy variable taking the value of 1 if the survey respondent is a member of an ethnic group classified as having a degree of pre-colonial political centralization at a level 2 or higher (with a total of range of 0 to 4). Source: (Murdock, 1967).

*Pre-Colonial Centralization Percentage*: Percentage of people in each local government unit who are a member of an ethnic group classified as having a degree of pre-colonial political complexity at a level 2 or higher (with a total of range of 0 to 4). Sources: (Government of Uganda, 2002; Murdock, 1967).

*Elevation*: Elevation in feet (logged) for each district capital. Source: Google Earth.

*Rainfall*: Annual rainfall, with measurements ranging across seven discrete values, from less than 800mm per annum (0) to more than 1800mm (6). Source: (Basalirwa, 1995)

#### Soil Types:

- *Lithosol*: Dummy variable which takes the value 1 when a significant portion of the district's soil is lithosol and 0 otherwise. Source: (Government of Uganda, 1967)
- *Vitrosol*: Dummy variable which takes the value 1 when a significant portion of the district's soil is vitrosol and 0 otherwise. Source: (Government of Uganda, 1967)