The Modern Impact of Precolonial Centralization in Africa

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Abstract

We assess, empirically and theoretically, the role of precolonial political institutions in shaping the performance of colonial and postcolonial African governments. Using anthropological data, we document a strong positive association between the provision of public goods such as education, health and infrastructure in African countries and the centralization of their ethnic groups' precolonial institutions. We present historical evidence supporting a "local accountability" hypothesis whereby precolonial centralization improved public goods provision by making local chiefs more accountable. To empirically identify this effect, we build a model of the impact of "local accountability" on public goods provision and test it against alternative hypotheses. Our results confirm the importance of the "local accountability" view for fully explaining the impact of precolonial centralization on public goods in Africa.

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1. Introduction

The economic literature on institutions holds that colonizers' strategies of conquest and rule are main determinants of the observed variation in the quality of government among former European colonies (e.g. La Porta et al. 1999, Acemoglu et al. 2001). Yet, several scholars stressed the importance of the precolonial institutions found by colonizers upon their arrival, and did so especially for Africa (e.g. Bates 1983, Boone 2003). In this continent, the impact of precolonial institutions was enhanced by the weakness of the colonial and postcolonial national state, which found it hard to broadcast its power into rural areas. For example, Herbst (2000, p.175) notices how "African states came to independence with almost no local structures besides those that were intertwined with traditional authorities".

In this context, Mamdani (1996) holds that the *centralization* of precolonial institutions shaped modernization efforts in Africa by increasing the accountability of local administrators in peripheral areas. He argues that in politically fragmented ethnic groups, local chiefs – often a colonial creation – were not restrained by a traditional system of checks and balances. As a result, these chiefs usurped the functions of the modern state for personal gain, leading to "decentralized tyranny". Mamdani argues that this problem was mitigated in centralized groups, where the existence of precolonial chiefly hierarchy made local chiefs accountable to higher-level traditional authority. Greater accountability of local chiefs in centralized groups could then be used by the colonial and postcolonial national state to foster policy coordination and implementation, thereby leading to faster adoption of European policies and technologies (e.g. Schapera 1970, Burke 1964).

This paper assesses, theoretically and empirically, the role of precolonial centralization in Africa. Using anthropological data on precolonial institutions and data on public goods across African countries for the 1960-2000 period, we find a strong and positive association between the share of a country's population belonging to ethnic groups with *centralized* (rather than *fragmented*) precolonial institutions and its provision of public goods such as health, education and infrastructure.

Although this finding confirms that centralized ethnic groups better adopted the new technologies of public goods provision brought by the Europeans, it does not – by itself – validate Mamdani's "local accountability" hypothesis whereby precolonial centralization fostered public goods provision in Africa by improving the quality of local government. In fact, two other broad hypotheses can explain our empirical finding. According to the first, centralized ethnic groups were simply socioeconomically more "advanced" (e.g. Claessen and Skalnik 1978), thus being more effective at adopting western technologies; in this view, precolonial institutions did not matter, only precolonial endowments did. The second hypothesis holds that precolonial centralization played an important but only indirect role by improving colonial and postcolonial political outcomes at the national level, not by affecting the behavior of local chiefs.

We try to disentangle these three hypotheses by following two strategies. First, we build a model of the benefits of precolonial centralization under the "local accountability" view. This view generates specific predictions on the relationship between public goods and precolonial centralization that are unlikely to hold under the alternative hypotheses. Hence, by empirically testing the model we can make progress toward identification. Second, we extensively control in our regressions for a large set of variables capturing both the advancement of a group and national level effects of precolonial centralization.

Our model of the impact of precolonial centralization on public goods relies on African colonial history, which we review in Section 3. Historians (e.g. Apter 1961, Tosh 1978) stress that, by increasing the accountability of local chiefs, precolonial centralization had two main benefits: it fostered the coordination between the chiefs of different districts and it reduced local tyranny, i.e. the extent to which local chiefs could abuse their masses. We find that, under these two effects, the impact of precolonial centralization on public goods provision should depend on the degree of social stratification of the local community, which measures the severity of local tyranny.¹

¹ Based on African colonial history, our model also indicates *how* precolonial centralization may have increased the accountability of local leaders. The mechanism is based on political competition effect. It is important to note, however, that our empirical test of the "local accountability" view does not rely on this specific political competition mechanism.

In particular, we find that under the "local accountability" view precolonial centralization should disproportionately boost public goods in stratified, as opposed to egalitarian, communities. Indeed, in stratified communities, precolonial centralization does not only improve interdistrict coordination but also curbs local tyranny, thereby exerting a greater positive impact on public goods. Crucially, the interaction between precolonial centralization and local stratification should also vary across public goods depending on their amount of interdistrict spillovers. In particular, in stratified communities precolonial centralization should boost low spillovers public goods (by reducing local tyranny) *and* high spillovers goods (by also improving coordination). In contrast, in egalitarian communities precolonial centralization should boost high spillovers goods but *not* low spillovers ones, as in these communities local tyranny is a minor problem.

We test these implications of the "local accountability" view by using another dimension of African ethnic groups coded in our anthropological dataset: the degree of social stratification at the local level. In line with our model, we find that precolonial centralization boosts public goods provision more in stratified communities than in egalitarian ones. Importantly, and again consistent with our model, the impact of precolonial centralization on a given public good depends on interdistrict spillovers. For high spillovers goods, such as roads and immunization, centralization benefits both stratified and egalitarian groups. In contrast, for education and infant mortality, centralization benefits stratified groups, but not egalitarian ones. Indeed, interdistrict spillovers should be less important for the public goods behind these latter outcomes (local schools and clinics).

Not only these results are consistent with the "local accountability" view of Mamdani (1996) and African historians; they are also hard to reconcile with the two alternative views that centralized groups were simply more "advanced" or that their institutions only improved national politics. A general version of these views predicts that – either for their advancement or better national politics – centralized groups should *uniformly* enjoy more public goods, irrespective of local stratification. Although in more nuanced versions of these hypotheses local stratification may matter, they still cannot explain the different patterns obtained for high and low spillovers goods.

In Section 6 we further evaluate the robustness of our findings by extensively controlling in our regressions for proxies capturing our alternative hypotheses. Ethnic-group and country-level proxies capture the factors anthropologists view as key attributes of socioeconomic advancement: urbanization and population density, easiness of transportation, use of writing, technological level, use of money, absence of slavery, fixity of residence, dependence on agriculture. As for national politics, we control for national political outcomes in the colonial and postcolonial periods. Our results are remarkably robust to the inclusion of different controls, pointing to a direct effect of precolonial centralization on public goods in Africa. In particular, the robustness of our theoretical predictions is highly consistent with the "local accountability" view and suggests that precolonial centralization did not only help to foster interdistrict coordination but also to soften local tyranny.

In sum, our paper indicates that *precolonial* centralization fostered modernization efforts in colonial and postcolonial Africa. With respect to the economic literature on institutions, our results suggest that not only the colonizers' strategies, but also preexisting political conditions affected quality of government in Africa. In particular, our evidence on the benefits of precolonial centralization echoes the finding that countries with a long tradition of statehood have better economic performance (Bockstette et al. 2002). Bockstette et al. (2002) argue that modern institutions work better when there are strong traditional institutions to build upon. Our results confirm this idea but further suggest that the key asset that allowed centralized groups to better provide public goods was their developed system of checks and balances that held local leaders accountable. Since traditionally fragmented groups lacked such accountability mechanisms, the unprecedented powers that modernization provided to their local chiefs led to decentralized tyranny and disorder (Mamdani 1996). In the Conclusions we draw some normative implications from our results for the debate on state building and centralization in developing and transition economies.

The paper is organized as follows. Section 2 presents our basic empirical findings. Section 3 reviews the role of precolonial institutions in African history. Section 4 presents a model of

precolonial centralization under the "local accountability" view. Section 5 tests the model. Section 6 controls for alternative hypotheses. Section 7 concludes.

2. Precolonial Centralization and Public Goods in Africa

We now build our cross-country measure of precolonial centralization and present the basic empirical finding of the paper, which motivates our subsequent analysis: the strong and positive association between the provision of public goods across African countries and the precolonial centralization of their ethnic groups. The analysis would ideally be performed at the ethnic-group level, but the lack of comparable subnational data on public goods prevents us from doing so.

2.1. The Data

Between 1962 and 1967, the anthropological journal *Ethnology* published several installments of the *Ethnographic Atlas* (Murdock 1967, World Cultures 1986), a database of around 60 variables describing the social, economic and political traits of 1270 ethnic groups around the world. The data, coded by the Yale anthropologist George P. Murdock, summarize the information of a multitude of individual field-studies done between 1850 and 1950. Murdock pinpointed every ethnic group to the earliest period for which satisfactory data existed to avoid the acculturative effects of contacts with Europeans. In Africa, Murdock's goal was to describe ethnic groups in the period immediately preceding the massive European colonization of the late 19th – early 20th century. We thus call African indigenous institutions as measured by his data "precolonial". Clearly, in certain parts of Africa, earlier contacts with Europeans (e.g. the slave trade) took place before the 19th century. Yet, like the economic literature on institutions (La Porta et al. 1999, Acemoglu et al. 2001) which focuses on the impact of European *administrative rule* on the colonies, we also focus on the period of European administrative rule because we believe this period to be crucial for understanding the role of precolonial institutions in modernization.

Murdock's *Jurisdictional Hierarchy* variable measures the degree of centralization of precolonial institutions, and gives for each ethnic group the number of jurisdictional levels transcending the local community. The variable attributes the value of 0 to groups "lacking any form of centralized political organization", 1 for "petty chiefdoms", 2 for "large paramount chiefdoms/small states" and 3 or 4 for "large states". For our purposes, we define "fragmented" an ethnic group falling into categories 0 or 1 and "centralized" a group scoring 2, 3 or 4 in Murdock's variable. Our "fragmented" category includes groups lacking any political integration above the local community, such as the Tonga of Zambia, and groups such as the Alur of Eastern Africa where petty chiefs rule over very small districts. Our "centralized" category comprises truly centralized kingdoms such as the Swazi in Southern Africa as well as large but less centralized political entities such as the Yoruba city-states in Southern Nigeria and the Ashanti confederation in Ghana.²

Having classified more than 300 African ethnic groups, we matched them with the groups listed in the *Atlas Narodov Mira*, published in 1964 by the Miklukho-Maklai Ethnological Institute in the Soviet Union, which provides the most comprehensive division of the world population into ethnic groups.³ We used the countries' ethnic composition from the Soviet Atlas to calculate the share of each country's non-European population belonging to centralized ethnic groups. This share represents our country-level index of precolonial centralization and we call it "Centralization".⁴ Our sample consists of 42 countries in Sub-Saharan Africa.⁵ Table A1 shows our Centralization index. The measure displays a wide cross-country variation, ranging from the

² Anthropologists (Fortes and Evans-Pritchard 1940) often label the same categories as "state/stateless". We avoid this terminology because the term "stateless" can misleadingly suggest that fragmented societies lack politics. The centralized/fragmented distinction better corresponds to the definition of the *Jurisdictional Hierarchy* variable we use.

³ Easterly and Levine (1997) built their ethnolinguistic fractionalization index using the Atlas. Alesina et al. (2003) and Fearon (2003) criticize the Atlas, using alternative ethnic partitions. Their critique does not appear to be relevant for Sub-Saharan Africa, so we continue to use the Atlas for its better coverage of African ethnic groups.

⁴ We exclude Europeans to focus on indigenous institutions, but their inclusion does not affect our empirical results.

⁵ We dropped Mauritius, Seychelles, Cape Verde and Sao Tome and Principe from the sample created by Robert Bates. These islands, uninhabited before the slave trade and colonization, do not have truly precolonial institutions.

value of 1 for Lesotho (both of its ethnic groups, the Sotho and the Zulu are highly centralized) to the value of 0 for Liberia (both the Kru and the Peripheral Mande lack political integration).

To study the role of precolonial centralization at the local level, we look at outcomes that are mainly determined away from capital cities. Our dependent variables measure country-level provision of local public goods such as education, health services and basic infrastructure. Infant mortality and the percentage of infants immunized against DPT (diphtheria, pertussis and tetanus) represent our health outcomes. Adult illiteracy rate and average school attainment proxy for education. The percentage of roads paved (as a share of total roads) is our measure of infrastructure⁶. These variables are from the 1960-2002 period, depending on data availability. Tables A2-A4 show descriptive statistics, pairwise correlations between our dependent variables and between Centralization and the controls we use. Our basic regression specification is:

$$Y_i = \alpha_0 + \alpha_1 * Centralization_i + \varepsilon_i$$

 Y_i is one of our outcome measures in country *i* and *Centralization*_i is the value of our index for that country. Parameter α_1 captures the association between precolonial centralization and public goods.

2.2. Basic Empirical Findings

The odd-numbered columns in Table 1 show the bivariate relationship between Centralization and different public goods outcomes; in even-numbered columns, we include initial per capita GDP to control for initial income differences across countries. Figures 1-5 show the results graphically. Centralization is positively associated with the quality of infrastructure as measured by the percentage of roads paved (Columns 1 and 2), with the percentage of infants immunized against DPT (Columns 3 and 4) and with the average years of school attainment (Columns 9 and 10). Our centralization index has a negative impact on infant mortality (Columns 5 and 6) and adult illiteracy (Columns 7 and 8), confirming that precolonial centralization is

⁶ We tried *life expectancy at birth* and, not surprisingly, all results were virtually identical to those for *infant mortality*. Using *percent of infants immunized against measles* (rather than DPT) also yields very similar results.

positively associated with the quality of health and education. All these relationships are statistically significant and economically large. For example, a change from 0 to 1 in our index⁷ (i.e. a move from a country only populated by fragmented groups to a country only populated by centralized groups) is associated with 42 fewer infants (out of every 1000) dying in the first year of life. This effect, equivalent to a reduction of 1.5 standard deviations in our sample, is twice as large as that of doubling initial GDP per capita. The magnitude of the association is similar for the other public goods, ranging from 1 to 2 standard deviations in the dependent variable and being larger than the effect of doubling initial GDP per capita.⁸

The comparison between the educational outcomes of Lesotho and Mali is instructive on the size of the correlation between Centralization and public goods. Lesotho had an average adult illiteracy rate of 25 percent in 1970-2002 and an average of 3.26 years of schooling in 1960-1990. Mali lies at the other extreme with an illiteracy rate of almost 83 percent and just 0.6 years of average schooling over the same time period. But while the Centralization index gives 1 for Lesotho, it only gives 0.115 for Mali, whose population is mostly from the politically fragmented Nuclear Mande and Voltaic ethnic groups. Thus, differences in precolonial centralization may capture more than a third of the observed differences in education between these two countries.

In sum, Table 1 shows that African countries inhabited by centralized groups enjoy a better provision of basic public goods. Yet, this evidence does not *per se* demonstrate that precolonial centralization was directly responsible for such better performance. To begin with, it would be helpful to see if this correlation originated in the colonial or the postcolonial period. Indeed, if precolonial institutions shaped the ability of African countries to adopt western policies and technologies, such effects probably originated in the formative colonial period when the major European innovations were introduced and the seeds of modernization were laid. In this view,

⁷ When we discuss the size of the coefficient on *Centralization*, we always refer to a change in the index from 0 to 1.

⁸ We checked for the presence of influential observations by computing the DFbetas from each regression in Table 1 (see, e.g., Belsley, Kuh and Welsch (1980, p. 28)). The only case of abs(DFbeta) > 1 is Comoros in road regressions. If we drop it, the coefficient is reduced to about 16, but remains 1 percent significant. If we more conservatively drop all observations with $abs(DFbeta) > 2/\sqrt{\#obs}$, the results become even stronger than those in Table 1.

centralized African groups had already jumped ahead in terms of education, health and infrastructure by the 1960s and the gap persisted after independence. Unfortunately, we cannot perform a detailed analysis of the impact of precolonial institutions in these different periods as all our public goods data are from the postcolonial period. Yet, since our data series begin as early as in 1960 for schooling and infant mortality and in 1970 for adult illiteracy, we can check how the association between our Centralization index and these outcomes has evolved since immediate postcolonial years. Figures 6-8 report the evolution of the magnitude and statistical significance of α_1 over time. The data provide some support for the thesis of early divergence: the coefficient for Centralization index becomes smaller (in absolute value) and less significant as we move further away from the colonial period. This suggests that African colonial history is key to understanding the role of precolonial centralization in modernization. Thus, looking to explain the association of Table 1, in the next section we review the colonial history of some African ethnic groups.

3. Historical Evidence

The colonial history of Uganda provides a very good starting point to examine the role of precolonial centralization in modernization. Scoring 0.634 in our Centralization index, Uganda displays a considerable variety of precolonial institutions *within* its borders. The South and the West of the country cover the territory of the precolonial kingdoms of Buganda, Bunyoro, Toro and Ankole. In contrast, the North of Uganda is entirely populated by fragmented ethnic groups such as Lango, Acholi and Karamoja. Finally, in the East one finds centralized Busoga as well as fragmented Teso and Bugisu societies. Map 1 shows the regional distribution of Ugandan ethnic groups and their precolonial centralization. Table 2 compares the quality of public goods across Ugandan regions using measures of infrastructure, health and education around the year 2000. The figures confirm *within* Uganda, our cross-country findings. The Central and Western Regions inhabited by centralized groups; the "mixed" Eastern Region has intermediate values.

Did precolonial institutions play a role in shaping such regional variation? Historical accounts of the colonial period suggest this to be the case. The British, who colonized the Ugandan territory between 1890 and 1910, immediately understood the importance of native authorities for implementing their policies and heavily relied on traditional chiefs for building roads, organizing schools, improving sanitation, and many other activities (Pratt 1965). As a result, British rule in Uganda was characterized by a strong continuity of precolonial institutions.

In the areas inhabited by centralized groups, such as the kingdoms of Buganda, Toro, or Ankole, the British upheld (in exchange for tribute) the precolonial system of government based upon hierarchy of chiefs (Apter 1961). In traditionally fragmented districts, such as Lango or Teso, the British yielded power to local chiefs selected from men of local standing (village headmen, clan heads). In the absence of precolonial political hierarchy, these local chiefs were directly subordinate to the Colonial Administration, but the paucity of European officers allowed them to exercise a good deal of unsupervised power (Low 1965).⁹ The direct consequence of this situation was that in Ugandan fragmented groups the local chiefs – accountable only to a distant colonial office – were relatively free to exploit their subjects. Indeed, Burke (1964, p. 37) reports that in Uganda arose "…*in the non-kingdom districts a system of effective but completely autocratic chieftainship. This contrasted with the situation in the kingdoms where the chiefs were restrained by the accountability of traditional authority"*.

The greater accountability of local chiefs in traditionally centralized systems clearly emerges from accounts on the Buganda, Bunyoro, Toro and other centralized Ugandan groups (Apter 1961, Richards 1960, Burke 1964). Crucially, historians stress that such accountability fostered modernization along two dimensions. First, it induced local chiefs to rule in the interest of their communities (Apter 1961), thereby fostering the introduction of new agricultural technologies (Richards 1960, Ehrlich 1965), religion and education (Low 1965), and modern health facilities

⁹ The British sometimes rearranged territorial entities, giving chiefs authority over wider regions than those they traditionally controlled. However, such reorganizations were neither extensive nor effective precisely because they were not built upon preexisting political structures (Low, 1965).

(Pratt 1965). Second, it improved coordination between local chiefs of different districts, who were all accountable to a common traditional authority. Perhaps unsurprisingly, this second effect boosted the ability of centralized groups to build roads (Pratt 1965) and to control epidemics (Low 1965).

In contrast, not only historians document the meager performance of modernization programs in precolonially fragmented districts, but they also attribute it precisely to the lack of accountability of their local chiefs. Burke (1964) depicts the Teso local chiefs as absolute tyrants. Tosh (1978, p.182) describes the abusive behavior of Lango chiefs, who "*exploited their office for personal or factional ends; and the ordinary population became alienated from the administrative structure*". He emphasizes that such behavior was a direct result of the fragmented nature of local politics among the Lango and shows how it distorted the administrative.

In sum, as suggested by Mamdani's (1996) "local accountability" view, during the colonial period modernization gave a great deal of power to local traditional authorities. Yet, while in fragmented groups unrestrained local chiefs abused this power, in centralized groups the traditional system of checks and balances prevented local chiefs from doing so. As a result, precolonially centralized groups were better able to implement modernization programs because in those groups a) the relationship between local chiefs and local masses was less tyrannical than in fragmented groups, and b) the efforts of local chiefs could be coordinated to a greater extent.

Further evidence confirms this picture for other African countries. The colonial history of the Tswana of Botswana (Schapera 1970, Wylie 1990), the Sotho of Lesotho (Ashton 1967, Breytenbach 1975), the Swazi of Swaziland (Schapera 1956) and other centralized groups of Southern Bantu, testifies that, by increasing the accountability of local chiefs, precolonial centralization fostered modernization. Likewise, Boone (2003) documents that in Senegal the centralized Wolof of the groundnut basin better supported the coordination and local implementation of development projects than the fragmented Diola of Lower Casamance, where the colonial (and later national) government had lesser ability to control the abusive behavior of local chiefs. A similar picture emerges from the history of fragmented groups of southern Cote d'Ivoire such as Baoule, Bete or Guru (Boone 2003).

Our econometric evidence presented in Table 1 and Figures 6-8 suggests that, although the impact of precolonial centralization was probably strongest in the colonial period, its effect remained sizeable long after independence. Accordingly, historians confirm the continuing importance of precolonial institutions in the postcolonial period. Some African countries, such as Botswana or Swaziland, reveal a clear continuity between postcolonial political leaders and precolonial rulers, as traditional patterns of politics influenced the nature of the postcolonial state itself (Potholm 1977, Picard 1987). Elsewhere, precolonial institutions continued to play an important role at the local level, where postcolonial African regimes (like their colonial predecessors) could not achieve their objectives without the cooperation of traditional power holders (e.g. van Rouveroy van Nieuwaal 1987). This pattern emerges from the accounts of Senegal, Cote d'Ivoire and Ghana (Boone 2003), where precolonial institutions profoundly influenced the ability of the postcolonial state to coordinate and discipline local chiefs and thus to reach the periphery. Interestingly, Herbst (2000) observes that postcolonial heads of state often had to come to pacts with traditional authorities even in countries such as Mauritania, Niger and Chad, where "states abolished or marginalized chiefs after independence only to invite them back a few years later in the face of extraordinary difficulties to govern the rural areas" (Herbst 2000, p.177).

To sum up, African history shows a clear continuity of precolonial institutions, and stresses their crucial role in modernization. In line with the "local accountability" view of Mamdani (1996), historians confirm that, by leading to greater coordination and reduced local tyranny, precolonial centralization helped to improve policy implementation in colonial and postcolonial Africa.¹⁰

¹⁰ The literature on federalism argues that *decentralization* may boost accountability of local administrators by fostering people's mobility (Tiebout 1956), improving voters' information (Besley and Case 1995) or enhancing voters' ability to replace misbehaving politicians (Seabright 1996). The latter two factors were irrelevant for fragmented African groups. As for migration, mobility costs are typically large in underdeveloped countries (Bardhan 2002). In addition, our historical evidence suggests that: a) Hostile inter-village relations discouraged migration; b) Chiefs skillfully

While the "local accountability" view offers a plausible explanation for the empirical association of Table 1, our empirical findings are also consistent with two alternative hypotheses. The first holds that centralized groups were just socioeconomically more "advanced". In this view, their greater ability to adopt western technologies for public goods provision was not due to their institutions but to their being, for instance, richer or more literate. A different hypothesis instead stresses that precolonial institutions did, in fact, play a role, but not by improving the quality of local government as emphasized by the "local accountability" view. In this second view, precolonial centralization improved national political outcomes, for instance by limiting the power of colonial and postcolonial national leaders. Reverse causality, on the other hand, is unlikely to drive the results of Table 1. African ethnic institutions certainly evolved over history, but they were predetermined at the end of the 19th century when the massive European colonization began. Historians agree that the technologies for providing modern public goods were first introduced by European administrators, who built the first road and railway networks and, together with missionaries, developed the system of formal education and built public-health facilities (Bauer 1975, Duignan and Gann 1975). These developments laid the foundation for further improvements in the postcolonial period, which is the source of our outcome measures. It is then difficult to see how the latter could have affected the Centralization index.

To empirically distinguish the "local accountability" view from the views that centralized groups were more advanced or induced better national politics, we follow two strategies. First, equipped with the historical background of this section, we build a model of public goods provision under the "local accountability" view. The model generates distinctive predictions that are unlikely to hold under the two alternative hypotheses, so by testing these predictions we can make progress toward identification. Second, we check the robustness of our results by extensively controlling for proxies for our alternative hypotheses.

manipulated people's incentive to move to their own advantage by banning or facilitating migration (Tosh 1978, Southhold 1964).

To follow the first strategy, it is important to understand the source of accountability in centralized groups. For instance, among the Buganda of Uganda local chiefs were appointed by the Kabaka (the king) or other high-level traditional authorities and could be abruptly dismissed if the performance of their district was poor (Low 1971). But did such accountability simply reflect the preference of precolonial central rulers for modernization or was it due to something else? Although not directly related to our empirical tests, answering this question allows us to model more realistically the mechanism that held local chiefs of centralized groups accountable and to derive the potential benefits of precolonial centralization from first principles.

An important insight to this question is offered by the history of the kingdom of Buganda. This kingdom maintained a dynamic political system with significant chances of promotion from office to office (Apter 1961, Low 1971). Crucially, historians document that the competition for higher office was won by local chiefs with larger local political support. A chief with more followers could better influence the king's appointment process through bribes, protest or by satisfying the king's need for soldiers (Apter 1961).¹¹ The accountability benefit of precolonial centralization was rooted in the very working of this mechanism: since the size of his constituency determined a chief's status and his chance of being promoted, competition for office ultimately behooved local chiefs to rule in the interest of their communities (Apter 1961). Hence, historians stress that the accountability benefit of precolonial centralization did not derive from the benevolence of high level traditional authorities, but from the enhanced political competition and the incentive it gave to local chiefs to build local support. Low (1971, p. 141) vividly describes this effect: "The ordinary peasant attached himself as a client-follower to a chief... Although the jurisdictions of chiefs could be very authoritative, the relation between chiefs and people does not seem to have been as autocratic as that between the Kabaka and his chiefs. For while chiefs were frequently on the move from one position to another, and while they were as liable to rapid disgrace as to rapid promotion, the people were free to attach themselves to a popular and

¹¹ The central apparatus often directly tested the popularity of a chief by consulting the local people (Richards, 1960).

successful chief, and equally free to desert (or intrigue against) an unpopular and unsuccessful one."

This picture is confirmed by many other accounts of centralized African groups.¹² Overall, the evidence confirms Bates' (1983, p. 41-42) general description of centralized African precolonial societies, where: "...to win and retain political power, political aspirants must attract followers, and to do so they must offer advantages, such as the opportunity to prosper." We now present a model showing how this accountability mechanism can indeed foster public goods provision both by inducing local chiefs to coordinate public policies across districts and by preventing their abuse of local masses.

4. A Model of Precolonial Centralization under the "Local Accountability" View

To understand the effect of precolonial institutions on local accountability (and to properly interpret our empirical results), one should think of a country as composed of many ethnic regions, each of which in turn consists of several districts belonging to a given ethnic group. Each district is administered by a local chief belonging to the district's *Elite*. In this context, precolonial centralization determines the accountability of local chiefs within each ethnic region. As in our discussion of colonial Uganda, in regions populated by centralized groups traditional accountability mechanisms hold local chiefs accountable. In contrast, in regions populated by fragmented groups such accountability mechanisms do not exist and local chiefs exert wider discretionary powers.

In line with historical evidence, we model the effects of precolonial centralization under the "local accountability" view by making two assumptions. First, the colonial government uses precolonial institutions for providing local public goods. We consider two versions of such delegation: an extreme one where colonizers only introduce modernization policies, leaving their

¹² For example, competition among the Tswana chiefs was pervasive. Success depended on followers' support and the chief was judged by how generously he spread the benefits of modernization throughout his realm (Wylie 1990). In the Sotho kingdom, the commoners could influence the king's appointment policy by gathering together. By allowing the locals to voice their interests and make demands to the central authorities, such gatherings served as a check on political abuses (Breytenbach 1975). Among the Southern Bantu, the power of chiefs also depended on the number of their followers. By ruling unjustly, a local chief risked alienating his own followers and being deposed (Schapera 1956).

implementation and financing to traditional authorities, and a more realistic one where the colonial government invests, but traditional authorities must cooperate in providing public goods. Second, the lack of accountability in fragmented groups has two potential costs: lack of coordination among local chiefs and their tyranny against local population.¹³ We capture these two aspects by modeling the amount of interdistrict spillovers of a given public good (which measures the cost of coordination failures), and the degree of social stratification at the local level (which captures the conflict of interest between the local chiefs – belonging to the *Elite* – and local *Masses*).

We assume that each ethnic region is divided into two districts. A measure one of citizens lives in district $i \in \{1,2\}$, where an amount $g_i \in \{0,1\}$ of a local public good is provided at unit cost *C*. The preferences over public goods and private consumption of citizen *j* in district *i* are

$$(1-k)g_i + kg_{-i} + m_i$$
.

 m_j is j's income. $k \in \{0, 1/2\}$ measures the interdistrict spillovers of the public good: if k = 0, there are no spillovers, if k = 1/2, spillovers are large. We assume:

A.1:
$$1/2 < C < 1$$
.

Thus, the good is costly but it is socially efficient to provide it in both districts. Let us now study how g_1, g_2 are determined under different precolonial political arrangements.

4.1. Regions Populated by Fragmented Groups

In each district, public goods are set and financed by a local chief belonging to the *Elite*. The *Elite* represents a share $s \in \{0,1\}$ of the local population and owns the total district wealth W>0. If s = 1, the group is egalitarian (i.e. everyone owns the same share of W); instead, if s = 0, the group is highly stratified (i.e. one person owns W)¹⁴. The lack of accountability in fragmented

¹³ These two costs of decentralization have been also discussed in the context of federalism (e.g. Riker 1964, Oates 1972, Blanchard and Shleifer 2001). We do not model any cost of precolonial centralization. Indeed, our aim here is not to provide a general theory of precolonial institutions but to empirically identify the benefit of precolonial centralization documented by our data.

groups is reflected in the assumption that each chief sets g_i to maximize the utility of the social class (*Elite*) he belongs to. Thus, the local chief of district *i* solves:

$$\max_{g_i \in \{0,1\}} s[(1-k)g_i + kg_{-i}] - Cg_i + W.$$

Since the *Elite* owns all local wealth, it must bear the full cost C of public goods, even though it only enjoys a share s of its value. Then, A.1 implies:

Proposition 1: In fragmented and stratified groups (s = 0) no public good is provided. In fragmented and egalitarian groups (s = 1), the good without spillovers (k = 0) is provided, but the good with large spillovers (k = 1/2) is not.

Proofs are in Appendix 3. Consistent with historical evidence, we find that in fragmented groups, the lack of accountability has two costs: local tyranny and lack of coordination. The first cost causes zero provision in stratified societies, where the local chief has no interest in spending resources for the *Masses*. The second cost causes zero provision of goods with large spillovers: even in egalitarian societies where rulers are fully benevolent with respect to the locals, they cannot coordinate across districts. Overall, Proposition 1 captures an advantage of egalitarian societies: in these societies there is no local tyranny, and local chiefs optimally provide low spillovers goods even in the absence of effective accountability mechanisms.

4.2. Regions Populated by Centralized Groups

In line with the historical evidence of Section 3, we model the accountability mechanism characterizing precolonially centralized groups as deriving from local chiefs' competition for higher office. Importantly, we show how such competition can both remove local tyranny and improve coordination, even if higher level traditional authorities are purely self-interested but sensitive to political influence. For concreteness, we assume that in centralized groups a traditional central ruler

¹⁴ This assumption is made for algebraic simplicity: our results also hold for $s \in (0,1)$. In an earlier version of the paper we obtained very similar results by assuming g_i to be continuous and subject to a quadratic cost of provision.

chooses public goods in both districts and rules through an administrative hierarchy. We model competition for office among chiefs (or equivalently, *Elites*) as follows. In each district *i*, the local chief buys the support of locals by promising (in case of victory) to persuade the central ruler to execute (g_i^i, g_{-i}^i) .¹⁵ The chief with larger local support wins the office, getting the rent of $\pi > 0$ associated with it. The central ruler implements the public goods policy proposed by the winner and finances it by taxing both chiefs equally. If the chiefs enjoy the same level of support, they share the rents; each chief gets $\pi/2$ and the spending level he proposes in his own district is implemented. To gain support, district *i* chief must promise a policy (g_i^i, g_{-i}^i) making the locals better off with respect to the promise made in district *-i*. For instance, in an equilibrium where both chiefs win support, district 1 plan (g_1^1, g_2^1) in response to district 2 plan (g_1^2, g_2^2) must satisfy:

$$(1-k)g_1^1 + kg_2^2 \ge (1-k)g_1^2 + kg_2^2 \qquad (PC)$$

The left-hand side of this participation constraint shows the value of public goods provision enjoyed by the locals of district 1 if they support their own chief (here both chiefs win, so in each district *i* the promise g_i^i of the local chief is executed). If instead they do not support their chief, they enjoy the public goods plan agreed upon in district 2. To win, district 1 chief sets (g_1^1, g_2^1) to maximize his payoff (i.e. the payoff of his local *Elite*), subject to *PC*. If *PC* is fulfilled, district 1 chief obtains support and enjoys rents from office plus his value of public goods minus half their total cost. If instead *PC* is not fulfilled, district 1 chief only gets his value of public goods minus half their total cost. The general tradeoff faced by district *i* chief is between boosting public goods, thus increasing the chances of winning (either by gaining more local support or by reducing the support of the competing chief), and paying more for their provision. Let us now assume:

A.2: $\pi > 2C$.

¹⁵ For simplicity, we do not allow monetary transfers from the *Elite* to the local masses. Such transfers would never be used in equilibrium, since public goods are cost effective and represent a more efficient way of providing benefits.

This assumption guarantees that the rents from office are sufficiently large, so that the chiefs are eager to provide public goods to win it. We then find:

Proposition 2: In centralized groups, public goods provision is always $g_1 = g_2 = 1$, irrespective of stratification and spillovers.

By inducing competition for higher administrative office among local chiefs, precolonial centralization boosts their accountability and hence public goods provision. Chiefs try to gain local support by promising more goods in their own district. In addition, they promise more goods in other districts, making it more costly for competing chiefs to gain support. The first effect eliminates local tyranny and thus the underprovision of low spillovers goods; the second effect also improves coordination and boosts the provision of high spillovers goods. Hence, consistent with historical evidence, our model shows that the accountability mechanism discussed in Section 3 can indeed reduce local tyranny *and* improve policy coordination.

Crucially for our empirical analysis, our model of "local accountability" separates the coordination benefit of centralization from its ability to remove local tyranny. The latter varies systematically with local stratification, the former with interdistrict spillovers. In egalitarian societies local tyranny is less of a problem, so centralization only boosts the provision of high spillovers goods. In stratified societies centralization solves both coordination and local tyranny problems, thus boosting the provision of high *and* low spillovers goods. Section 4.4 describes how this prediction can help to build an empirical test of the "local accountability" view.

4.3. Precolonial Centralization and Colonization

Suppose now that colonialists themselves finance public goods and wish to provide more goods than local *Elites*, for simplicity $g_1 = g_2 = 1$. However, they cannot provide these goods without the cooperation of traditional authorities. In particular, suppose that local provision is fully

executed by precolonial authorities, who interact with colonialists in the following way: t=0: colonialists advance *C* to local chiefs; t=1: local chiefs set the level of public goods.

Under these assumptions, public goods provision depends on precolonial centralization in the exact same way it did in Propositions 1 and 2. After colonialists have advanced *C*, the cost and benefit of providing public goods are borne by traditional authorities. The only difference now is that colonialists only invest if they anticipate that traditional authorities will provide public goods.

4.4. Centralization, Stratification and the Empirical Identification of "Local Accountability"

The centralization-stratification matrix below reports the provision of g_1 and g_2 under the "local accountability" view for all possible types of ethnic groups, summarizing the predictions of the model:

	Stratified	Egalitarian
Centralized	1	1
Fragmented	0	1-2k

From top to bottom we measure whether the ethnic group is centralized or fragmented; from left to right whether it is stratified or egalitarian at the local level. In line with our empirical results, we find that precolonial centralization should boost public goods. The matrix shows that this is due to greater coordination and reduced local tyranny. In egalitarian societies there is no problem of local tyranny, so centralization is beneficial for high spillovers goods (k=1/2), but not for low spillovers ones (k=0). In stratified societies, not only does centralization foster greater coordination, but it also softens local tyranny, boosting the provision of *any* public good, irrespective of *k*.

At this point, it is useful to see the predictions of our theory with respect to the public goods considered in our empirical analysis. For this purpose, we must classify our public goods outcomes with respect to spillovers. An objective measure of spillovers is not available, but for the variables considered, it is possible to characterize with a certain confidence whether the underlying public good is closer to the ideal of "low spillovers" ($k \approx 0$) or to that of "high spillovers" ($k \approx 1/2$).

For instance, paved roads are clearly close to the ideal of high spillovers goods, as they facilitate mobility across districts. Conversely, the public goods behind educational outcomes such as illiteracy and schooling can be interpreted as being closer to the low spillovers ideal, as confirmed by the empirical estimates of low external returns to education (Acemoglu and Angrist 2000). The classification of our health measures is less straightforward, but the following distinction seems reasonable. The infectious nature of diphtheria, pertussis and tetanus can create widespread epidemics, so that immunization against them is closer to the high spillovers ideal. But infectious diseases are only one cause of mortality.¹⁶ Other diseases are less transmittable and the factors reducing their impact (e.g. availability of medical supplies, access to clean water, modern sanitation facilities) are more locality-specific. Thus, unlike immunization, public goods reducing infant mortality are presumably closer to the low spillovers ideal. Bardhan (2002) stresses the same distinction between the control of epidemics and the provision of general health facilities in terms of size of spillovers involved.

We thus classify paved roads and infant immunization as high spillovers goods ($k \approx 1/2$) and expect the centralization-stratification matrix for these outcomes to look like matrix M1 below:

M1	Stratified	Egalitarian
Centralized	1	1
Fragmented	0	0

In contrast, we classify the public goods behind adult illiteracy, schooling and infant mortality as low spillovers goods and expect for these outcomes a pattern similar to matrix M2 below:

¹⁶ As shown in Table A3, the correlation in our sample between infant mortality and the DPT immunization rate is about 0.31, indicating that around 90% of the variation in infant mortality is associated with other factors.

M2	Stratified	Egalitarian
Centralized	1	1
Fragmented	0	1

M1 and M2 summarize the main predictions of our model of "local accountability". First, the benefit of precolonial centralization is larger for stratified groups, where centralization – in addition to internalizing spillovers – helps to remove local tyranny. Second, the interaction between centralization and stratification depends on spillovers: for high spillovers goods centralization benefits *both* stratified and egalitarian groups, for low spillovers goods it benefits stratified groups, but *not* egalitarian ones.

Importantly, these two predictions of the "local accountability" view are not easily fulfilled under the alternative hypotheses that might otherwise explain the positive association between precolonial centralization and public goods. Consider, for instance, the hypothesis that centralized groups were just more "advanced", so that they could naturally produce more public goods. In terms of our model, one could state this view by assuming that advanced groups have a smaller cost of providing public goods C' < C. Then, such groups would be expected to fare better irrespective of stratification, thus yielding the provision pattern M1. A similar uniform effect holds under the view that precolonial centralization rendered national governments more effective, irrespective of the conditions prevailing at the local level (which also induces a lower cost of provision). Both views would thus be inconsistent with a larger benefit of centralization for stratified groups.

More nuanced versions of these hypotheses may claim that a group's advancement or its ability to support national politics is related to both its centralization and its stratification. For instance, it may be argued that only centralized *and* stratified groups are really advanced or can effectively improve national politics. Yet, these alternative versions would still be inconsistent with our matrices: they would predict a positive provision only for the centralized-stratified cell of the matrix (or the centralized-egalitarian groups if they are viewed as the better ones). In general, any story that, disregarding the accountability effects of centralization, views centralization *and* stratification as proxies for a third (omitted) factor, would predict a greater benefit of centralization for either stratified or egalitarian groups. As such, it would be hard to reconcile with the evidence of different patterns of provision (those in M1 and M2) across different types of public goods.

5. Estimating the Centralization-Stratification Matrix

We now propose a strategy for estimating our centralization-stratification matrix. In line with our discussion, if our public goods outcomes confirm the predictions of the model, then the evidence lends support to the "local accountability" view, as the alternative hypotheses are unlikely to yield the joint predictions of our model.

5.1. Empirical Strategy

To estimate the centralization-stratification matrix, we need a measure of stratification at the local level. We use the *Class Stratification* variable from Murdock's *Ethnographic Atlas*. This variable codes, for each ethnic group, the degree of class stratification at the local level in five mutually exclusive categories. Three of them concern the type of stratification. "Elite", "dual" and "complex" stratification indicate patterns whereby the *Elite* derives its superior hereditary status from control over scarce resources (e.g. land), from traditionally ascribed nobility and from occupation, respectively. All three categories comprise societies with class distinctions (i.e. with small entrenched *Elites* in terms of our model), so we code the ethnic groups belonging to any one of them as "stratified". Other ethnic groups either do not have class distinctions or have only wealth distinctions, which are "not crystallized into distinct and hereditary social classes". Since social classes are absent under both definitions, we code these groups as "egalitarian".¹⁷

¹⁷ See Appendix 1 for the precise definitions of different categories of the *Class Stratification* variable.

Combining the class stratification of African ethnic groups with our previous centralizedfragmented distinction, we allocate each group to one of the four possible types of precolonial political systems, each corresponding to a cell of our centralization-stratification matrix.¹⁸ For every country in our sample, we find the share of its non-European population falling into each of the four cells. Table A5 shows the cross-country distribution of these shares. Then, we estimate our centralization-stratification matrix for public good outcome *Y*, using the following OLS regression:

$$Y_i = \beta_0 + \beta_1 * Centr \& Strat_i + \beta_2 * Fragm \& Strat_i + \beta_3 Centr \& Egal_i + \varepsilon_i$$

 Y_i is the value of the public good outcome in country *i*. *Centr* & *Strat*_i, *Fragm* & *Strat*_i and *Centr* & *Egal*_i are the shares of centralized and stratified, fragmented and stratified and centralized and egalitarian ethnic groups in country *i*. The share of fragmented and egalitarian ethnic groups is omitted from our regressions, so that β_1 , β_2 and β_3 represent the quality of public goods in other precolonial political systems, *relative to that benchmark*. Thus, we estimate the following empirical equivalent to our centralization-stratification matrix:

ME	Stratified	Egalitarian
Centralized	$\beta_1 = 2k$	$\beta_3 = 2k$
Fragmented	$\beta_2 = -(1-2k)$	0

Our theory can thus be tested by focusing on the sign and significance of the "difference-indifference" coefficient $(\beta_1 - \beta_2 - \beta_3)$. This coefficient indicates whether precolonial centralization is more beneficial for stratified or egalitarian ethnic groups, as it subtracts the benefit of precolonial centralization in the latter (β_3) from that in the former groups $(\beta_1 - \beta_2)$.

¹⁸ Incidentally, in line with the ideas of Fried (1967), in our sample there is a positive (but far from perfect) correlation between centralization and stratification of about 0.7. This suggests that, if anything, the alternative hypothesis holding that centralized *and* stratified groups are the better ones should have more bite.

In this respect, the "local accountability" view implies that $(\beta_1 - \beta_2 - \beta_3)$ should be either positive or zero, consistent with a greater benefit of Centralization for stratified groups. Crucially, the pattern of the coefficient should depend on spillovers. For high spillovers ($k \approx 1/2$) goods such as paved roads and immunization, our theory predicts – in line with matrix M1 – a uniform benefit of Centralization across stratified and egalitarian groups. We thus expect ($\beta_1 - \beta_2 - \beta_3$) to be zero, driven by β_1 and β_3 which are positive and of similar magnitude. Indeed, Centralization should improve the provision of high spillovers goods in both stratified and egalitarian groups. Conversely, for low spillovers goods ($k \approx 0$), such as schooling, illiteracy and infant mortality, we expect – in line with matrix M2 – political fragmentation to be costly only when it leads to local tyranny, i.e. only in stratified groups. Thus, we expect a positive ($\beta_1 - \beta_2 - \beta_3$), reflecting a benefit of Centralization in stratified groups (driven by $\beta_2 < 0$ for the "local tyranny" effect) and no effect of Centralization in egalitarian groups (i.e. $\beta_3 = 0$).

5.2. Empirical Findings

Table 3 presents the estimated centralization-stratification matrices ME for our public goods measures. To check whether actual provision patterns are consistent with our theoretical predictions, we report (in bold) the estimate and the standard error of $(\beta_1 - \beta_2 - \beta_3)$. For completeness, we also report estimates and standard errors of $(\beta_1 - \beta_2)$ and $(\beta_1 - \beta_3)$. Panel A reports these estimates when we do not control for initial income; Panel B shows the results obtained when initial per capita GDP is included. Because of the similarity of the results, we only focus our discussion on those reported in Panel B.

Columns 1 and 2 describe our findings for paved roads and DPT immunization. The results, highly consistent with the high spillovers nature of these goods, mimic the pattern of matrix M1: $(\beta_1 - \beta_2 - \beta_3)$ is very insignificant, indicating that the benefit of centralization is uniform across stratified and egalitarian groups. Moreover, β_1 and β_3 are large, statistically significant and of similar magnitude. They indicate a 22-percentage-point increase in paved roads and a 37 to 42 percentage-point increase in DPT immunization, associated with the greater coordinating ability of centralized polities.¹⁹ As predicted by the model, the results confirm a *uniform* benefit of precolonial centralization across stratified and egalitarian societies for high spillovers goods.

The matrices in columns 3, 4 and 5 show our findings for the low spillovers public goods considered: infant mortality, illiteracy rate and schooling. The results drastically differ from those of columns 1 and 2 and are now highly consistent with the pattern of matrix M2. In line with the predictions of our model, the highly significant $(\beta_1 - \beta_2 - \beta_3)$ suggests that for low spillovers goods, centralization mainly benefits stratified groups. Indeed, for all these public goods, β_2 is statistically significant and has a sign which suggests that introducing stratification into fragmented societies deteriorates public policies aimed at expanding education and health services. In fragmented groups, stratification increases infant mortality by 74 and the illiteracy rate by 36.39 percentage points and reduces average school attainment by 2.17 years. These effects are extremely large (equivalent to a change of about 2 standard deviations in our dependent variables) and confirm the presence of local tyranny in fragmented groups.²⁰

The estimates of $(\beta_1 - \beta_2)$, also large and highly significant (at the 1% level) for all three variables, confirm the benefit of precolonial centralization for stratified groups and support the idea that, when the distribution of power is highly unequal, centralization softens local tyranny. Centralization reduces the number of infants who die by 100 (out of 1000), cuts illiteracy by 57.65 percentage points and increases schooling by 3.18 years. All these effects are larger than 3 standard deviations. In contrast, β_3 is very small and not statistically distinguishable from 0 for all three variables, indicating that in egalitarian groups precolonial centralization does not have any effect on the provision of low spillovers public goods.

¹⁹ In columns 1 and 2 estimates of β_1 - β_2 are noisy, with low significance. Yet, β_1 and β_3 are similar in size and β_2 is not statistically different from 0, so we do not conclude that there is no coordination benefit in stratified groups.

²⁰ The large adverse effect of stratification on education in fragmented groups suggests that local tyranny may be especially severe for this outcome. Chiefs are likely to be very reluctant to invest in mass education, as it can undermine their political power. For instance, missionary education often attempted to supplant African values with Western ones.

To summarize, the evidence presented in Table 3 is consistent with the "local accountability" view because: 1) precolonial centralization is more beneficial for stratified than for egalitarian groups and 2) for high spillovers goods (such as paved roads and DPT immunization) centralization benefits *both* stratified and egalitarian groups, while for low spillovers goods (such as education and infant mortality) it benefits stratified groups, but *not* egalitarian ones.

These results show that the positive association between precolonial centralization and public goods outcomes in Africa is likely to be due, at least in part, to the "local accountability" view. Omitted variables or indirect effects of precolonial centralization are not the whole story: as discussed in Section 4, they are unlikely to fully explain the findings of this section.

6. Evaluation of Alternative Hypotheses

Although the findings of the last section already support the "local accountability" view, we further evaluate its robustness by directly controlling for several proxies for our alternative hypotheses. We include these proxies one at a time in our baseline regressions where we also control for initial income so as to capture general cross-country differences in economic status and minimize possible omitted variable bias in the coefficient on Centralization. Tables 4 to 6 report the results of this exercise. For the basic regressions, we report the value and the standard error of the coefficient on Centralization, as well as those for the relevant proxy. For the test of the centralization-stratification matrix, we report the value and the standard error of the "difference-in-difference" coefficient $\beta_1 - \beta_2 - \beta_3$. The robustness of $\beta_1 - \beta_2 - \beta_3$ is especially important: the evidence supports the "local accountability" view insofar as the patterns in the matrix remain unaffected. Let us examine the view that centralized groups were more advanced.

6.1. First Alternative Hypothesis: Socioeconomic Advancement

At this point, it is important to be precise on what we mean by socioeconomic advancement. Centralization itself can be viewed as an index of advancement. Yet, anthropologists (e.g. Murdock and Provost 1973) noticed that other factors are also indicative of a group's status. They identify eight other dimensions of advancement: urbanization and density of population, easiness of transportation, use of writing, technological level, use of money, absence of slavery, fixity of residence, dependence on agriculture. In this section, we separate the effect of precolonial centralization by controlling for the effects of these other dimensions. Interestingly, although some of our controls are standard country-level variables, many of the proxies we use in this section are new country-level indexes, which we build by aggregating ethnic-group level variables taken from the anthropological dataset.²¹ This section has thus some independent interest because it exploits new sources of variation in the precolonial characteristics of African ethnic groups. Below we review the eight dimensions of "advancement" one by one.

– *Urbanization and population density*. Population density and urbanization do not only capture a group's economic advancement (and thus its ability to provide public goods), but they may also affect the likelihood of centralization. For instance, high population density may increase the pressure on resources, leading the rich to use centralization to keep their power. In addition, densely populated or urbanized areas may better afford the fixed cost of a centralized administrative apparatus.²² We measure these factors using the country-level population density and the urbanization rate in 1960.²³ Because in some countries (e.g. Niger) a majority of the population may live in a small densely populated part of the country's territory, we control for population density both relative to total area and to arable land.

Easiness of transportation. Transport costs affect "advancement" by shaping socioeconomic exchange, but they may also shape political organization (Polanyi 1957, Gluckman 1965, Lenski 1966). For instance, environments favorable to trade (e.g. harbors, rivers) may induce the

²¹ See Appendix 1 for the exact definitions of these controls.

²² Acemoglu et al. (2002) argue that Europeans were more likely to set up extractive institutions in densely populated or urbanized areas. In this case, we would expect a *negative* spurious correlation between Centralization and public goods.

²³ Controlling for the population density in 1900 produces similar results.

establishment of centralized enforcement agencies to make trade prosper. Based on these theories, we picked these two controls: the landlocked dummy and the length of inland waterways.

- *Use of writing*. Groups using writing and written records are likely to better absorb and communicate the information involved in adopting new technologies. But writing may also help these groups to support centralization. We control for Murdock's *Writing and Records* variable, indicating whether a group had a precolonial system of writing and possessed written records.

- *Technological level*. Technologically more advanced groups are likely to better adopt modern technologies, as they may be richer or more skilled. The same factors may also affect a group's ability to centralize, so we control for this possibility using Murdock's *Metal* variable, indicating whether metalworking was present or absent in the precolonial economy of an ethnic group.

- *Use of money*. Money is also a technology, whose goal is to facilitate economic exchange. Thus, for the reasons mentioned before, we control for this technology in our regressions by including Murdock's *Money* variable, indicating whether an ethnic group used money as a medium of exchange in its precolonial economy.

– *Slavery*. History of slavery and slave trade could impede the formation of centralized political systems, but it could also lead to a lower quality of government and a lower level of public goods provision (Nunn 2005). We control for this possibility by using Murdock's *Slavery* variable indicating the prevalence of slavery in precolonial times for each ethnic group.

Table 4 shows the results for urbanization and population density, easiness of transportation, use of writing, technological level, use of money and slavery. Panel A shows the results for the level regressions. The effect of Centralization remains large and significant, while the proxies we introduce do not generally have a strong predictive power.²⁴ Panel B shows the results for our centralization-stratification matrix to be robust to the inclusion of new controls, remaining consistent with the "local accountability" view. In roads and immunization regressions

 $^{^{24}}$ Surprisingly, the regressions show a negative association between precolonial writing and health and educational outcomes. This is largely due to the fact that the use of writing was much more prevalent in Muslim areas (cross-country correlation of 0.72), which tend to have lower levels of these public goods.

 $(\beta_1 - \beta_2 - \beta_3)$ is statistically indistinguishable from 0, indicating that for high spillovers goods, the benefit of precolonial centralization is uniform across stratified and egalitarian societies. The predictions of our model are also fulfilled for low spillovers goods. Education and infant mortality regressions estimate $(\beta_1 - \beta_2 - \beta_3)$ which is generally significant and has the right sign, thereby suggesting a larger benefit of precolonial centralization for stratified groups. Hence, the data are consistent with the view that precolonial centralization fostered the provision of low spillovers goods by reducing local tyranny. We now consider other proxies for socioeconomic advancement.

- *Fixity of residence*. It can be harder for nomadic groups to invest in socioeconomic advancement (or in schools, hospitals or infrastructure that lead to it), but it may also be harder for them to build a centralized apparatus. To control for this effect, we use Murdock's *Settlement Pattern* variable, indicating, for each ethnic group, whether it is nomadic or has permanent settlements.

– *Dependence on agriculture*. In addition to being an indicator of advancement, agricultural productivity is also likely to favor centralization (Braudel 1972). Thus, we control for Murdock's *Share of Agriculture in Subsistence Economy* variable indicating, for each group, the importance of agriculture relative to animal husbandry, fishing and hunting-gathering. We also control for country-level geographic variables like the area of water reservoirs (measuring water abundance), the average height of mountains (measuring the availability of agricultural lands and climate), patterns of land usage²⁵, and measures of climate such as climate types and the absolute value of latitude. The latter variables also control for other theories of centralization such as Wittfogel's (1957) "irrigation hypothesis" or Carneiro's (1970) "geographical circumscription theory".

Table 5 shows the results for fixity of residence and dependence on agriculture. Panel A shows the results for level regressions. Once again, in the vast majority of specifications, the effect of Centralization remains large and significant, while the proxies we introduce do not generally have a strong predictive power (except for climate). Only controlling for a country's average

²⁵ By including forests, the land usage proxy also controls for transport costs.

elevation weakens our illiteracy and infant mortality results and drastically reduces the effect of Centralization on schooling. This is due both to the significant direct impact of elevation on these public goods and its high correlation (0.51) with centralization. Importantly, however, the inclusion of elevation does not affect the pattern of our centralization-stratification matrix for education and infant mortality, still consistent with that of low spillovers public goods.

More generally, Panel B shows that the results for our centralization-stratification matrix are also robust to the inclusion of new controls. Centralization continues to disproportionately benefit stratified groups for low spillovers goods (i.e. $(\beta_1 - \beta_2 - \beta_3)$ is generally significant and has the right sign), while generating a uniform benefit for high spillovers good (i.e. $(\beta_1 - \beta_2 - \beta_3)$ is indistinguishable from 0).²⁶ These results are consistent with the "local accountability" view.

6.2. Second Alternative Hypothesis: National Politics

The hypothesis that precolonial centralization only had an indirect effect, affecting political outcomes at the national level, can be formulated in two broad versions. The first deals with the possibility that precolonial centralization influenced the strategies of the colonizers. The second focuses on its impact on the political space of African countries after independence. In this subsection, we evaluate the importance of such indirect stories.²⁷ The bottom part of Table A4 already suggests that these indirect effects are unlikely to be important, as most of the correlations between our measures of precolonial institutions and the proxies for national political outcomes are small and statistically insignificant. Yet, we still want to explicitly evaluate the validity of the "local accountability" view against these indirect stories by directly controlling for them in our regressions.

²⁶ Land usage and climate types slightly weaken $(\beta_1 - \beta_2 - \beta_3)$ for adult illiteracy. Yet, even in these specifications centralization benefits stratified groups $((\beta_1 - \beta_2)$ is significant at the 5% level) but not egalitarian ones. In general, the features of our matrix are preserved in all our specifications (results are available from the authors).

²⁷ Notice that urbanization and population density can also be affected by centralization. For instance, the presence of decision-making centers may attract people from peripheries and boost urbanization. Thus, our previous robustness results can also be viewed as rejecting other indirect channels through which centralization might have worked.

- *Colonial factors*. Acemoglu et al. (2001) suggest that Europeans set up better institutions (probably leading to more public goods) in colonies where they could settle more easily. Centralized precolonial systems may have just facilitated European settlement, perhaps by allowing them to deal more effectively with indigenous population. To account for this possibility, we control in our regressions for the fraction of a country's population of European descent in 1960. La Porta et al. (1999) find that English colonies tend to have better governments than French ones. Either by coincidence or by choice, the English might have been more likely to rule over centralized groups (better suited to their strategy of Indirect Rule). Our basic regressions would then pick up the benefit of being an English colony, not that of centralization per se. We control for this possibility using the English legal origin variable.

Finally, precolonial institutions may have facilitated or impeded the arrival of missionaries, who brought with them not only their credo but also efforts aimed at improving literacy and health conditions. Therefore, we control for the share of a country's population belonging to Catholic, Muslim, Protestant or other religions. The results here must be interpreted with caution. The assimilation of religious values may itself be endogenous to education policies and depend on the impact of Centralization on the latter. Controlling for religion might bias the coefficient of Centralization downward, but we still want to see how it affects the results.

Panel A of Table 6 confirms that our basic results are generally robust to the colonization stories. Only in schooling regressions is the coefficient of Centralization weakened when we control for the percentage of Europeans or religion shares, as countries with larger European settlements and/or with a larger share of Protestants attain better educational outcomes. Yet, we are reassured about the impact of Centralization on education by the results for adult illiteracy (for which we have a much larger sample), which are unaffected by the inclusion of those controls.²⁸ Panel B shows that controlling for colonial factors does not affect our centralization-stratification

²⁸ Notice also that, consistent with the findings of La Porta et al. (1999), African countries of English legal origin fare better in health and education.

matrix. For roads and DPT immunization, the data confirm a uniform impact of precolonial centralization due to spillovers. For low spillovers goods, it is still the case that precolonial centralization is particularly beneficial for stratified societies. Only for educational outcomes does $(\beta_1 - \beta_2 - \beta_3)$ lose its significance when we control for religion. However, for adult illiteracy it is still true that centralization benefits stratified but not egalitarian societies ($\beta_1 - \beta_2$ is 5 percent significant, while β_3 is zero).²⁹ In addition, as noticed above, the results for education may be downward biased when we control for religion.

– *Postcolonial factors*. In Africa civil wars are an important feature of a country's national politics. The risk of having a civil war may depend on the precolonial institutions. For instance, the degree of interethnic military conflict can be a function of the organization of the groups involved (Fearon and Laitin 1996). We control for this channel by including the frequency of a country's civil wars in our regressions. A country's precolonial institutions may also have exerted a far-reaching impact on the political regime at the national level. For instance, centralized groups could provide mechanisms for political participation and representation after independence, putting constraints on the behavior of national political elites.³⁰ To account for this indirect effect of centralization, we include two standard measures of checks and balances in our regressions: the indexes of Democracy and Constraints on the Executive.

Finally, being centered on ethnic groups' characteristics, our analysis is related to the literature on the effects of ethnic fractionalization (see Alesina and La Ferrara (2003) for a review). The standard approach defines ethnicity as based on language and views the costs of fractionalization as being due to cultural barriers in interethnic relations. Instead, we focus on intraethnic interaction and explicitly consider a group's political organization as its most salient characteristic. Since centralized political organization may reduce the scope for distinctive cultural

²⁹ Full results are not shown, but available from the authors.

³⁰ Instead, Acemoglu et al. (2002) make an opposite argument. In their view, the centralized indigenous structure provided the basis for the establishment of extractive institutions by colonial and postcolonial elites.

differences, we include the Ethnolinguistic Fractionalization index of Easterly and Levine (1997) in our regressions to control for this indirect channel.³¹

Table 6 tends to reject the channels working through postcolonial national politics. In Panel A, we do not find any evidence supporting the role of Ethnolinguistic Fractionalization. The coefficients on Civil Wars, Democracy and Constraints on the Executive generally have the expected sign but are not significant on a consistent basis. More importantly, the results for our Centralization index remain remarkably robust. Likewise, Panel B documents that our centralization-stratification matrix is not affected by the inclusion of postcolonial controls either.

Overall, the evidence of this section corroborates our results from Section 5 and tends to reject the hypotheses that centralized groups fared better just because they were more advanced or because precolonial institutions only had an indirect effect through national politics. Instead, the data are broadly consistent with the presence of a direct impact of precolonial centralization on public goods. Importantly, the estimation of our centralization-stratification matrix supports the "local accountability" view and suggests that precolonial centralization boosted public goods provision by helping both to internalize spillovers and to soften local tyranny.

7. Conclusions

This paper assesses, empirically and theoretically, the view that precolonial centralization affected the quality of government in colonial and postcolonial Africa. We document a positive association between the provision of modern public goods such as education, health and infrastructure in African countries and the centralization of their precolonial political institutions.

We present historical evidence suggesting that in Africa, in line with the "local accountability" view of Mamdani (1996), precolonial centralization improved the provision of local public goods by rendering local chiefs more accountable. In light of this evidence, we build a

³¹ Scholars recently moved from language to other dimensions of ethnicity. Caselli and Coleman (2002) argue for the salience of physical differences as a determinant of ethnic conflict. Alesina et al. (2003) and Fearon (2003) proposed "identity" based definitions of ethnicity, which are hard to conceptualize into a specific operational criterion.

model of "local accountability" where precolonial centralization boosts public goods both by internalizing spillovers and by softening local tyranny. By testing the predictions of our model and by extensively controlling for alternative hypotheses, we find that the "local accountability" view is important to fully explain the impact of precolonial centralization on public goods in Africa.

From a normative standpoint, our analysis sheds some light on the debate on institutional reform in transition and developing countries. It has long been argued that a critical determinant of the ability of these countries to effectively implement modernization programs rests on the proper working of the local government, especially on the incentives faced by local administrators (Bardhan 2002). In this respect, our analysis suggests that institutional reforms aimed at fostering modernization efforts in the periphery should optimally respond to local conditions and integrate preexisting local power structures into the implementation of government programs.

For example, in the African context our analysis suggests that in regions populated by fragmented groups the national state or even international institutions may need to play a more direct role in the implementation of modernization programs, especially if the local community is very unequal: delegating public goods provision to these regions may simply exacerbate the costs of local tyranny and lack of coordination. On the other hand, the central state may follow a more hands-off, indirect approach in regions populated by centralized ethnic groups: delegating public goods provision to these regions may reduce the central government's overload and permit greater flexibility to local conditions without reducing effectiveness of policy implementation.

From a broader perspective, these observations relate to the policy debate on centralization. In policy circles, administrative decentralization is widely believed to make the local government more accountable and efficient. This idea has a long pedigree in economics (e.g. Tiebout 1956, Besley and Case 1995, Seabright 1996), but it ultimately rests on the assumption that the local political system is able to discipline local administrators. Yet, our analysis illustrates that – when the political structure is very fragmented and when there are profound socioeconomic inequalities – decentralization may allow local administrators to greatly distort the implementation of public
programs to their own advantage, disregarding the broad interest of their communities. Additional evidence from around the world – from Russia to India to Latin America³² – confirms that under decentralization local power holders may often subvert policy implementation to their own advantage. Our findings suggest – in parallel with Riker's (1964) classic study of federalism – that under such circumstances administrative *centralization* may be the best way to increase the accountability of local administrators and foster the implementation of socioeconomic reforms.

Somewhat paradoxically, these observations imply that if at the subnational level there is a concentrated power holder, then the national state should try to bargain with him and delegate to him policy implementation, so as to exploit his power to render the local government more efficient. By contrast, if at the subnational level political power is dispersed among many power holders, then our analysis seems to suggest that the national state should try to crush them and centralize policy formulation and implementation. We believe that these arguments are central for nation building in countries such as Iraq, Afghanistan or the Palestinian territories.

³² See Shleifer and Treisman (1999) on Russia; Lieten (1996) and Mathew and Nayak (1996) on India; Fox (1990) on Latin America.

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Map 1. Distribution of centralized and fragmented ethnic groups across Uganda regions



Figure 1: Precolonial centralization and paved roads (partial relation controlling for log of GDP/cap in 1986)



Figure 2: Precolonial centralization and infant immunization (partial relation controlling for log of GDP/cap in 2001)



coef = -42.503394, (robust) se = 15.1238, t = -2.81

Figure 3:Precolonial centralization and infant mortality (partial relation controlling for log of GDP/cap in 1960)



Figure 4: Precolonial centralization and adult illiteracy (partial relation controlling for log of GDP/cap in 1970)



Figure 5: Precolonial centralization and school attainment (partial relation controlling for log of GDP/cap in 1960)



(1) The chart shows the values of the coefficient for *Centralization* index from the OLS regressions of

InfantMortality_i = $\alpha_0 + \alpha_1 * Centralization_i + \alpha_2 * \log(GDP / cap_1960)_i + \varepsilon_i$, where infant mortality is measured in different years.

(2) The coefficient is significant at the 1% level between 1960 and 1967, and at the 5% level between 1970 and 2001.

(3) The regressions have 39 observations between 1960 and 1967, and 40 observations between 1970 and 2001.

Figure 6: Precolonial centralization and infant mortality: relationship over time



(1) The chart shows the values of the coefficient for *Centralization* index from the OLS regressions of *AdultIlliteracy_i* = α₀ + α₁ * *Centralization_i* + α₂ * log(*GDP*/*cap*_1970)_i + ε_i, where adult illiteracy is measured in different years.
 (2) The coefficient is significant at the 1% level between 1970 and 1988, and at the 5% level between 1989 and 2002.
 (3) All regressions have 36 observations.

Figure 7: Precolonial centralization and adult illiteracy: relationship over time



(1) The chart shows the values of the coefficient for Centralization index from the OLS regressions of

SchoolAttainment_i = $\alpha_0 + \alpha_1 * Centralization_i + \alpha_2 * \ln(GDP / cap_1960)_i + \varepsilon_i$, where school attainment is measured in different years.

(2) The coefficient is significant at the 1% level in 1960 and 1965, at the 5% level in 1970, 1975 and 1990, and at the 10% level in 1980 and 1985.

(3) The regressions have 21 observations in 1960 and 1965, 23 in 1970, 24 in 1975, 25 in 1980, and 26 observations in 1985 and 1990.

Figure 8: Precolonial centralization and school attainment: relationship over time

		-	% of i	nfants						
	% of roa	ds paved	immunize	ed for DPT	Infant r	nortality	Adult illi	teracy rate	School a	ttainment
	in 199	0-2000	in 2	2001	in 196	in 1960-2001		0-2002	in 1960-1990	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Centralization	21.02***	21.53***	36.79***	36.08***	-35.24**	-42.5***	-18.74**	-23.77***	1.24**	1.24**
	(7.21)	(7.04)	(6.53)	(7.13)	(14.79)	(15.12)	(9.04)	(8.29)	(0.47)	(0.49)
Log of initial GDP/cap		4.95		0.9		-23.8**		-11.17**		0.36
		(3.38)		(2.5)		(9.26)		(4.56)		(0.61)
Constant	7.12**	-26.72	38.11***	33.22*	146.6***	306.72***	66.94***	145.63***	1.2***	-1.12
	(2.65)	(22.73)	(4.85)	(17.37)	(10.01)	(63.48)	(5.95)	(32.36)	(0.33)	(3.91)
Obs	40	40	42	41	42	40	37	36	26	26
Rsq	0.24	0.27	0.33	0.31	0.13	0.23	0.1	0.26	0.12	0.14

Table 1: Precolonial centralization and public goods provision

Notes:

(1) OLS estimations.

(2) "Initial GDP/cap" refers to GDP/cap in 1960 for columns 6 and 10, in 1970 for column 8, in 1986 for column 2 and in 2001 for column 4.

(3) Robust standard errors are shown in parentheses.

(4) *** denotes significance at the 1% level, ** at the 5% level, * at the 10% level.

Region	Central	Western	Eastern	Northern
Precolonial institutions of ethnic groups	Centr	Centr	Mixed	Fragm
% of roads paved in 2002	13.37	10.32	10.89	1.33
Infant mortality in 2001	71.9	97.8	89.3	105.9
% of children under five years with diarrhoea in 2001	14.5	16	23.3	26.7
Availability of sewerage system in 2000 (% of households)	15	14	9	6
Piped water inside house in 2000 (% of households)	10	10	8	5
Availability of latrine or human waste disposal service in 2000 (% of households)	96	86	77	67
Adult literacy rate in 1997	72	61	54	54
Adequacy of facility & equipment at primary schools in 2000 (% of households satisfied)	62	72	55	51

Table 2: Precolonial centralization and public goods in Uganda

Sources: Uganda Bureau of Statistics (1999, 2003), Uganda Bureau of Statistics and ORC Macro (2001)

1 0.000 110 110 00000000						
	% of roads paved in 1990-2000	% of infants d immunized for DPT in 2001	Infant mortality in 1960-2001	Adult illiteracy rate in 1970-2002	School attainmen in 1960-1990	
	(1)	(2)	(3)	(4)	(5)	
StratEgalitCentr β_1 β_3 Fragm β_2 0	22.23*** 17.36* (7.99) (8.02) 5.1 0 (10.07) 0	37.73*** 40.06** (7.48) (19.4) 11.17 0 (23.44) (19.4)	-33.54** 19 (13.63) (27.91) 75.89** 0 (37.22) 0	-16.41* 5.08 (8.87) (13.73) 45.67** 0 (21.45) (21.45)	1.01* -0.59 (0.54) (1.08) -2.21** 0 (0.95) (1.08)	
$egin{array}{lll} eta_1 &-eta_2\ eta_1 &-eta_3\ eta_1 &-eta_2 &-eta_3\ eta_1 &-eta_2 &-eta_3 \end{array}$	17.13 (13.75 4.88 (11.07 -0.22 (15.88	26.56(21.23)-2.33(18.68)-13.5(31.86)	-109.43*** (35.06) -52.54* (28.63) -128.43*** (46.33)	-62.09*** (20.31) -21.5* (12.68) -67.17** (25.44)	3.22***(0.83)1.59(0.96)3.8**(1.5)	
Obs	40	42	42	37	26	
Rsq	0.24	0.34	0.32	0.27	0.28	

Table 3: Testing the ''local accountability'' hypothesis: precolonial centralization, class stratification and public goods provision

Panel A: No controls

Table 3: Testing the '	'local accountability''	hypothesis: precolonial	centralization, class stratifica	tion and public goods provision
------------------------	-------------------------	-------------------------	----------------------------------	---------------------------------

		% of infants				
	% of roads paved	immunized for DPT	Infant mortality	Adult illiteracy rate	School attainment	
	in 1990-2000	in 2001	in 1960-2001	in 1970-2002	in 1960-1990	
	(1)	(2)	(3)	(4)	(5)	
Strat Egalit						
Centr β_1 β_3	22.89*** 22**	37.18*** 42.11*	-37.2** 10.4	-21.27** -2.89	1.01* -0.54	
	(7.72) (8.4)	(8.56) (21.86)	(14.31) (28.55)	(8.58) (16.95)	(0.55) (1.16)	
Fragm $\beta_2 = 0$	10.03 0	12.7 0	74** 0	36.39 * 0	-2.17 ** 0	
	(10.88)	(26.25)	(34.27)	(20.31)	(0.9)	
$\beta_1 - \beta_2$	12.86 (14.61)	24.48 (22.83)	-111.2*** (31.57)	-57.65*** (18.74)	3.18*** (0.78)	
$\beta_1 - \beta_3$	0.88 (11.7)	-4.94 (19.93)	-47.6* (27.58)	-18.38 (15.94)	1.55 (1.06)	
$\beta_1 - \beta_2 - \beta_3$	-9.15 (18.15)	-17.63 (36.69)	-121.6*** (44.66)	-54.76** (26.85)	3.72** (1.48)	
Obs	40	41	40	36	26	
Rsq	0.28	0.32	0.39	0.37	0.29	

Panel B: Controlling for Log of initial GDP/cap

Notes:

(1) β_1 , β_2 and β_3 refer to the OLS estimations of $Y_i = \beta_0 + \beta_1$ *Centr-&-Strat_i + β_2 *Fragm-&-Strat_i + β_3 *Centr-&-Egalit_i + $X'_i\gamma + \epsilon_i$.

(2) "Initial GDP/cap" refers to GDP/cap in 1960 for columns 3 and 5, in 1970 for column 4, in 1986 for column 1 and in 2001 for column 2.

(3) Robust standard errors are shown in parentheses.

(4) *** denotes significance at the 1% level, ** at the 5% level, * at the 10% level.

Table 4: Testing the "advancement" hypothesis: demography, trade, technology and slavery

Panel A: Basic centralization results	Dependent variables										
	% of roads paved in 1990-2000	% of infants immunized for DPT in 2001	Infant mortality in 1960-2001	Adult illiteracy rate in 1970-2002	School attainment in 1960-1990 (5)						
Specifications	(1)	(2)	(3)	(4)							
Centralization No "advancement" controls	21.53*** (7.04)	36.08*** (7.13)	-42.5*** (15.12)	-23.77*** (8.29)	1.24** (0.49)						
Centralization	20.5 *** (4.89)	31.13*** (8.39)	-43.6** (17.88)	-25.07** (10.18)	1.41** (0.51)						
Population density in 1960	0.031 (0.15)	0.15 (0.096)	0.037 (0.152)	0.035 (0.083)	-0.009 (0.006)						
Centralization	21.62*** (7.34)	36.64 *** (7.52)	-41.95*** (14.26)	-23.53** (8.97)	1.45**(0.58)0.004*(0.002)						
Population density per arable land in 1960	-0.016 (0.014)	0.009 (0.034)	0.043 (0.048)	-0.02 (0.018)							
Centralization	22.76*** (7.84)	30.42*** (8.25)	-47.58*** (17.12)	-25.42** (11.12)	1.74** (0.65)						
% of urban population in 1960	0.096 (0.164)	-0.414 (0.316)	-0.65 (0.647)	-0.115 (0.357)	0.054 (0.037)						
Centralization	24.54*** (8.15)	36.26 *** (7.8)	-44.23*** (15.79)	-22.93*** (8.37)	1.3 ** (0.56)						
Landlocked dummy	-6.26 (5.1)	-0.39 (5.85)	4.15 (9.38)	-2.11 (5.68)	-0.09 (0.42)						
Centralization	23.94*** (7.36)	38.1 *** (8.14)	-43.72*** (15.6)	-23.93*** (8.48)	1.23** (0.52)						
Inland waterways	338.63* (176.08)	548.8 (575.73)	216.24 (350.4)	369.91** (159.41)	7.71 (25.74)						
Centralization	21.66*** (6.89)	34.83*** (6.87)	-39.7** (15.86)	-19.78** (8.2) 23.47*** (8.5)	1.04** (0.48)						
Writing	0.67 (4.87)	-16.78** (8.16)	22.99 (13.77)		-1.8*** (0.5)						
Centralization	21.78 ** (8.1)	33.87*** (7.4)	-40.19** (15.31)	-20.8** (7.84)	1.08** (0.51)						
Metal	1.49 (10.64)	-13.76 (8.79)	20.69 (20.36)	19.07* (10.9)	-0.75 (0.56)						
Centralization	23.61** (8.92)	33.26 *** (7.24)	-42.8*** (15.03)	-21.27** (7.92)	1.16** (0.5)						
Money	7.18 (8.11)	-9.86 (6.92)	-1.19 (15.76)	9.83 (7.95)	-0.22 (0.81)						
Centralization	20.42** (8)	33.04 *** (7.59)	-33.52** (14.76)	-15.97** (7.38) 28.42*** (8.66)	0.81* (0.46)						
Slavery	-4.59 (10.47)	-17.49 (10.42)	39.83** (18.92)		-1.08** (0.44)						

Panel B: Centralization-Stratification matrix		Dependent variables								
$(\beta_1 - \beta_2 - \beta_3)$ % of roads pair in 1990-20		ds paved)-2000	% of infants paved immunized for DPT 2000 in 2001		Infant mortality in 1960-2001	Adult illiteracy rate in 1970-2002	School attainmen in 1960-1990			
"Advancement" controls	(1)	(2	2)	(3)	(4)	(5))		
No controls	-9.15	(18.15)	-17.63	(36.69)	-121.6*** (44.66)	-54.76** (26.85)	3.72**	(1.48)		
Population density in 1960	-11.03	(15.17)	-29.32	(36.4)	-125.99*** (46.13)	-60.11** (28.76)	3.79**	(1.62)		
Population density per arable land in 1960	-9.46	(18.53)	-19.88	(36.79)	-124.46*** (44.08)	-52.44* (27.5)	3.27***	(1.14)		
% of urban population in 1960	-10.3	(18.11)	-11.94	(37.4)	-118.33** (45.73)	-54.72* (27.89)	3.22**	(1.41)		
Landlocked dummy	-8.11	(17.1)	-17.68	(37.01)	-121.64*** (44.16)	-54.57* (27.69)	3.71**	(1.5)		
Inland waterways	-1.85	(18.45)	-8.72	(35.46)	-128.33** (48.82)	-50.8* (29.63)	4.6**	(1.86)		
Writing	-9	(17.83)	-28.98	(32.47)	-113.19** (44.1)	-40.49* (23.74)	2.38	(1.67)		
Metal	-9.64	(17.85)	-14.16	(37.3)	-120.28** (45.64)	-53.18* (28.23)	3.68**	(1.53)		
Money	-25.7	(17.69)	-2.4	(46.13)	-160.44*** (47.37)	-90.71*** (22.13)	4.63***	(1.42)		
Slavery	-10.18	(19.26)	-20.72	(36.44)	-104.39** (45.56)	-41.71 (26.21)	3.22*	(1.74)		

Table 4: Testing the "advancement" hypothesis: demography, trade, technology and slavery

Notes:

(1) Panel A shows coefficients and robust standard errors for Centralization index and "advancement" controls introduced one at a time.

(2) Panel B shows coefficients and robust standard errors of $\beta_1 - \beta_2 - \beta_3$ from the OLS estimations of

 $Y_i = \beta_0 + \beta_1 * Centr-\&-Strat_i + \beta_2 * Fragm-\&-Strat_i + \beta_3 * Centr-\&-Egalit_i + X'_i\gamma + \epsilon_i, where "advancement" controls are introduced one at a time.$

(3) All regressions control for *Log of initial GDP/cap* from Tables 1 and 3.

(4) All regressions have 40, 41, 40, 36 and 26 observations in columns 1 to 5 respectively, except those including *Population density per arable land* (39, 40, 40, 35, 26 observations) and those including *Inland waterways* (38, 39, 38, 34, 25).

(5) *** denotes significance at the 1% level, ** at the 5% level, * at the 10% level.

Panel A: Basic centralization										
			% of i	nfants						
	% of road	ls paved	immunize	d for DPT	Infant mo	ortality	Adult illite	eracy rate	School at	tainment
in 1990-2000		in 2	001	in 1960-	2001	in 1970-2002		in 1960)-1990	
Specifications	(1)	(2	2)	(3)		(4))	(5)	
Centralization No "advancement" controls	21.53***	(7.04)	36.08***	(7.13)	-42.5***	(15.12)	-23.77***	(8.29)	1.24**	(0.49)
Controlization	71 71***	(6.08)	35 01***	(7.14)	_17 /1***	(15 30)	_73 38***	(8 30)	1 7/**	(0.5)
Permanent settlements	2.52	(6.64)	12.06	(8.98)	-2.28	(16.71)	-5.31	(9.12)	0.6	(1.35)
Centralization	21.5***	(7.11)	36.79***	(7.23)	-42.24***	(14.94)	-23.59***	(8.31)	1.48**	(0.61)
Dependence on agriculture	0.32	(1.14)	1.57	(1.98)	0.61	(3.72)	0.99	(1.88)	0.28	(0.22)
Centralization	21.43***	(6.98)	36.65***	(7.03)	-41.52**	(15.71)	-23.66***	(8.45)	1.15**	(0.5)
Water area	-15.48	(22.68)	94.32**	(42.15)	39.27	(60.34)	4.32	(30.93)	-2.55	(1.92)
Centralization	23.1***	(6.35)	32.2***	(8.59)	-40.19**	(19.38)	-21.69*	(11.82)	0.97	(0.64)
p-value for Land usage shares	[0.0]	5]	[0.5	53]	[0.43	3]	[0.3	3]	[0.	5]
Centralization	18.25**	(7.06)	33.51***	(10.29)	-31.67**	(15.48)	-20.95**	(9.48)	1.29	(0.78)
p-value for Climate types	[0]	[0.	1]	[0.07	7]	[0.5	1]	[0.0)8]
Centralization	18.37**	(7.82)	34.49***	(7.95)	-50.87***	(14.36)	-24.5***	(7.05)	1.49**	(0.59)
Latitude	33.07	(28.29)	15.4	(33.07)	80.9	(58.72)	7.99	(40.57)	-2.02	(3.39)
Centralization	29.48***	(9.63)	32.7***	(8.78)	-29.04	(17.93)	-11.23	(8.6)	0.48	(0.61)
Average elevation	-8.3*	(4.33)	3.51	(4.7)	-14.58*	(7.74)	-13.44**	(5.49)	0.77*	(0.43)

Table 5: Testing the "advancement" hypothesis: fixity of residence and dependence on agriculture

Panel B: Centralization-Strat	tification m	atrix			Dependent variabl	es						
$(\beta_1 - \beta_2 - \beta_3)$		% of infants										
	% of roa in 199	ds paved 0-2000	immunized for DPT in 2001		Infant mortality in 1960-2001	Adult illite in 1970	Adult illiteracy rate in 1970-2002		tainment)-1990			
"Advancement" controls	(1)	(2	2)	(3)	(4)	(5	j)			
No controls	-9.15	(18.15)	-17.63	(36.69)	-121.6*** (44.66)	-54.76**	(26.85)	3.72**	(1.48)			
Permanent settlements	-9.32	(18.37)	-23.59	(36.25)	-123.59*** (43.37)	-54.34*	(27.87)	3.85**	(1.72)			
Dependence on agriculture	-9.03	(18.71)	-20.21	(37.02)	-121.86*** (44.87)	-56.61**	(27.08)	3.55**	(1.59)			
Water area	-9.92	(18.29)	-13.09	(28.78)	-120.21** (46.87)	-55.32**	(26.83)	3.64**	(1.6)			
Land usage shares	1.58	(16.16)	-26.74	(43.47)	-112.72** (54.84)	-50.06	(32.68)	3.67*	(1.94)			
Climate types	-6.33	(21.76)	-54.87	(38.1)	-102.05** (44.1)	-43.05	(32)	3.8*	(2.12)			
Latitude	-1.79	(19.07)	-16.24	(41.8)	-115.88** (45.6)	-61.01**	(29.58)	3.65**	(1.36)			
Average elevation	-5.26	(17.44)	-18.97	(36.55)	-115.17*** (42.28)	-47.06**	(19.71)	3*	(1.51)			

Table 5: Testing the "advancement" hypothesis: fixity of residence and dependence on agriculture

Notes:

(1) Panel A shows coefficients and robust standard errors for Centralization index and "advancement" controls introduced one at a time.

(2) Panel B shows coefficients and robust standard errors of $\beta_1 - \beta_2 - \beta_3$ from the OLS estimations of

 $Y_i = \beta_0 + \beta_1 * Centr-\&-Strat_i + \beta_2 * Fragm-\&-Strat_i + \beta_3 * Centr-\&-Egalit_i + X'_i\gamma + \epsilon_i, where "advancement" controls are introduced one at a time.$

(3) All regressions control for *Log of initial GDP/cap* from Tables 1 and 3.

(4) All regressions have 40, 41, 40, 36 and 26 observations in columns 1 to 5 respectively, except those including Land usage (39, 40, 40, 35, 26 observations).

(5) *** denotes significance at the 1% level, ** at the 5% level, * at the 10% level.

(6) In Panel A the p-values for Land usage shares and Climate types refer to the F tests of joint significance.

Panel A: Basic centralization results					Dependent	variables				
			% of i	nfants						
	% of roads paved		immunize	d for DPT	Infant mortality		Adult illiteracy rate		School attainment	
	in 1990	-2000	in 20	001	in 1960-2001		in 1970-2002		in 1960	-1990
Specifications	(1))	(2	()	(3)		(4)		(5)
Centralization	21.53***	(7.04)	36.08***	(7.13)	-42.5***	(15.12)	-23.77***	(8.29)	1.24**	(0.49)
No colonial or postcolonial controls										
Centralization	15.86***	(4.8)	36.57***	(7.55)	-40.42**	(16.27)	-24.26**	(8.96)	0.55	(0.71)
% of European descent in1960	-46.74	(51.07)	-20.13	(48.64)	-45.65	(147.98)	-109**	(52.24)	76.42	(46.52)
Centralization	20.96***	(7.38)	31.97***	(6.49)	-40.93**	(16)	-18.55**	(6.86)	1.1***	(0.39)
English legal origin	3.86	(3.84)	16.79***	(5.49)	-16.85*	(9.18)	-18.32***	(4.77)	0.65	(0.41)
Centralization	26.7***	(7.31)	36.71***	(6.69)	-35.74**	(15.59)	-18.33**	(8.87)	0.7	(0.68)
Catholics	-0.15	(0.16)	-0.07	(0.18)	0.34	(0.39)	0.4	(0.24)	-0.02	(0.03)
Muslims	0.14	(0.13)	0	(0.16)	0.5*	(0.25)	0.52**	(0.19)	-0.04*	(0.02)
Other religions	0.11	(0.15)	0.29	(0.19)	0.27	(0.32)	0.42	(0.25)	-0.04	(0.03)
Centralization	21.58***	(7.28)	37.84***	(7.38)	-44.71***	(14.65)	-24.77***	(8.15)	1.6***	(0.45)
Civil wars in 1970-92	-1.13	(8.46)	-17.6	(12.03)	31.92	(26.55)	13.33	(16.24)	-3.12***	(0.91)
Centralization	19.95**	(7.73)	32.03***	(8.13)	-37.65**	(15.07)	-24.05**	(8.99)	1.29**	(0.52)
Democracy in 1970-94	1.09	(0.95)	2.39*	(1.29)	-2.73*	(1.61)	-0.6	(1.03)	-0.03	(0.05)
Centralization	20.25**	(7.57)	33.23***	(8.04)	-38.41**	(15.33)	-23.82**	(8.86)	1.24**	(0.5)
Constraints on the executive in 1970-94	1.64	(1.6)	3.17	(2.06)	-4.08	(2.44)	-1.76	(1.65)	-0.01	(0.07)
Centralization	25.47***	(8.83)	35.19***	(8.13)	-43.08**	(15.99)	-23.21**	(9.27)	1.08	(0.72)
Ethnolinguistic fractionalization	12.03	(11.64)	-2.21	(7.35)	-1.64	(11.84)	1.27	(8.95)	-0.33	(1.03)

Table 6: Testing the "national politics" hypothesis: colonial and postcolonial factors

Panel B: Centralization-Stratification ma											
$(\beta_1 - \beta_2 - \beta_3)$		% of infants									
	% of road in 1990	% of roads paved in 1990-2000		immunized for DPT in 2001		Infant mortality in 1960-2001		Adult illiteracy rate in 1970-2002		ainment -1990	
Colonial and postcolonial controls	(1	.)	(2	2)	(3)		(4)		(5)	
No controls	-9.15	(18.15)	-17.63	(36.69)	-121.6***	(44.66)	-54.76**	(26.85)	3.72**	(1.48)	
% of European descent in 1960	-19.06	(14.48)	-16.66	(37.54)	-121.47**	(45.21)	-52.42*	(27.22)	3.41**	(1.45)	
English legal origin	-8.28	(17.03)	-10.6	(30.31)	-120.33***	(43.63)	-51.93**	(24.56)	3.64**	(1.43)	
Religion variables	12.83	(20.62)	-25.56	(36.83)	-106.07**	(44.05)	-32.66	(21.92)	0.67	(2.08)	
Civil wars in 1970-92	-9.37	(19.32)	-16.86	(37.47)	-122.33**	(46.81)	-52.82*	(27.51)	3.2**	(1.33)	
Democracy in 1970-94	-5.58	(17.24)	-4.19	(34.11)	-127.5***	(46.3)	-56.48*	(28.9)	3.66**	(1.48)	
Constraints on the executive in 1970-94	-4.89	(17.57)	-5.57	(35.57)	-133.52***	(44.34)	-60.3**	(28.77)	3.78**	(1.51)	
Ethnolinguistic fractionalization	-7.28	(17.9)	-17.57	(37.32)	-122.06**	(46.79)	-54.76**	(26.86)	3.76**	(1.54)	

Table 6: Testing the "national politics" hypothesis: colonial and postcolonial factors

Notes:

(1) Panel A shows coefficients and robust standard errors for *Centralization* index and colonial or postcolonial controls introduced one at a time.

(2) Panel B shows coefficients and robust standard errors of $\beta_1 - \beta_2 - \beta_3$ from the OLS estimations of

 $Y_i = \beta_0 + \beta_1$ *Centr-&-Strat_i + β_2 *Fragm-&-Strat_i + β_3 *Centr-&-Egalit_i + $X'_i\gamma + \varepsilon_i$, where colonial and postcolonial controls are introduced one at a time.

(3) All regressions control for *Log of initial GDP/cap* from Tables 1 and 3.

(4) All regressions have 40, 41, 40, 36 and 26 observations in columns 1 to 5 respectively, except those including % of Europeans (39, 40, 39, 35, 26 observations)

and those including *Democracy* or *Constraints on the executive* (39, 39, 40, 35, 26).

(5) *** denotes significance at the 1% level, ** at the 5% level, * at the 10% level.

Appendix 1

	Data and Sources
Dependent variables	
% of roads paved in 1990-2000	Average of roads paved (as percent of total roads) for the years 1990-2000. Paved roads are roads that have been sealed with asphalt or similar road-building materials. Scale 0-100. Source: Based on World Bank World Development Indicators (2003).
% of infants immunized for DPT in 2001	Infant immunization measures the rate of vaccination coverage of children under one year of age. A child is considered adequately immunized against DPT (diphtheria, pertussis or whooping cough, and tetanus) after receiving two or three doses of vaccine, depending on the immunization scheme. Scale 0-100. Source: World Bank World Development Indicators (2003).
Infant mortality in 1960-2001	Average of infant mortality rate for the years 1960-2001. Infant mortality rate is the number of infants who die before reaching one year of age, per 1,000 live births in a given year. Source: Based on World Bank World Development Indicators (2003).
Adult illiteracy rate in 1970-2002	Average of adult illiteracy rate for the years 1970-2002. Adult illiteracy rate is the proportion of adults aged 15 and above who cannot, with understanding, read and write a short, simple statement of their everyday life. Scale 0-100. Source: Based on World Bank World Development Indicators (2003).
School attainment in 1960-1990	Average of school attainment for the years 1960-1990. Each value is an average of schooling years in the total population over the age of 15. Source: Based on Barro and Lee (1994).
Main independent variables	
Centralization	For each country measures the share of the non-European population that belongs to indigenously "centralized" ethnic groups. Scale is 0 to 1. An ethnic group is defined as "centralized" if it has 2, 3 or 4 jurisdictional levels above the local community according to Murdock's (1967) <i>Jurisdictional Hierarchy</i> variable. (It is defined as "fragmented" if it has 0 or 1 levels) Source: Constructed by the authors using Murdock (1967) and Atlas Narodov Mira (1964).

Continued

Data and Sources (continued)

Centralization-Stratification shares	For each country measure the shares of the non-European population that belongs to precolonially centralized and stratified, fragmented and stratified, centralized and egalitarian or fragmented and egalitarian ethnic groups. Scale is 0 to 1. An ethnic group is defined as "centralized" if it has 2, 3 or 4 jurisdictional levels above the local community according to Murdock's (1967) <i>Jurisdictional Hierarchy</i> variable. It is defined as "fragmented" if it has 0 or 1 levels. An ethnic group is defined as "stratified" if Murdock's (1967) <i>Class Stratification</i> variable indicates that the group is characterized by one of the following: a) "elite stratification, in which an elite class derives its superior status from, and perpetuates it through, control over scarce resources, particularly land, and is thereby differentiated from a propertyless proletariat or serf class"; b) "dual stratification into a hereditary aristocracy and a lower class of ordinary commoners or freemen, where traditionally ascribed noble status is at least as decisive as control over scarce resources" or c) "complex stratification into social classes correlated in large measure with extensive differentiation of occupational statuses". A group is defined as "egalitarian" if according to the same variable it is characterized by a) "absence of significant class distinctions among freemen, ignoring variations in individual repute achieved through skill, valor, piety, or wisdom" or b) "wealth distinctions based on the possession or distribution of property present and socially important but not crystallized into distinct and hereditary social classes". Source: Constructed by the authors using Murdock (1967) and Atlas Narodov Mira (1964).
Log of GDP per capita	Logarithm of GDP per capita in constant 1985 dollars (international prices).
in 1960, 1970 and 1986	Source: Global Development Network Growth Database, based on Penn World Table 5.6.
Log of GDP per capita	Logarithm of GDP per capita in constant 1995 dollars (international prices).
in 2001	Source: World Bank World Development Indicators (2003).
Population density in 1960	Total population in 1960 divided by land area in square kilometers. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. Refugees not permanently settled in the country of asylum are generally considered to be part of the population of their country of origin. Land area is a country's total area, excluding area under inland water bodies. In most cases the definition of inland water bodies includes major rivers and lakes. Source: Based on World Bank World Development Indicators (2003).
Population density per arable land in 1960	Total population in 1960 divided by arable land in square kilometers. Arable land includes land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Source: Based on World Bank World Development Indicators (2003).
% of urban population	Urban population is the midyear population of areas defined as urban in each country and reported to the United Nations. It is measured here as the percentage of the total population. Scale 0-100.
in 1960	Source: World Bank World Development Indicators (2003).

Continued

Landlocked	Dummy variable taking value 1 if a country is landlocked, 0 otherwise. Source: Parker (1997).
Inland waterways	Length of inland waterways (km) divided by land area (km sq). Land area is a country's total area, excluding area under inland water bodies. In most cases the definition of inland water bodies includes major rivers and lakes. Source: Based on Parker (1997) and World Bank World Development Indicators (2003).
Writing	For each country measures the share of the non-European population that belongs to ethnic groups that had precolonial system of writing. Scale is 0 to 1. An ethnic group is defined as having a precolonial system of writing if according to <i>Writing and Records</i> variable of Murdock and Provost (1973): a) it "has an indigenous system of true writing and possesses written records of at least modest significance" or b) it "has an indigenous system of writing but lacks any significant accumulation of written records, or alternatively has long used the script of alien people". In contrast, a group is defined as lacking a pre-colonial system of writing if: a) it "lacks true writing but possesses significant nonwritten records in the form of picture writing, quipus, pictorial inscriptions, or the like"; b) "writing and significant records are lacking but the people employ mnemonic devices, e.g., simple tallies" or c) "writing, records, and mnemonic devices in any form are lacking or unreported".
Metal	For each country measures the share of the non-European population that belongs to ethnic groups that had metalworking (e.g., forging or casting of metal artifacts) activity present in their precolonial economy. Scale is 0 to 1.
Money	 For each country measures the share of the non-European population that belongs to ethnic groups that used money as medium of exchange in their precolonial economy. Scale is 0 to 1. An ethnic group is defined as using money as medium of exchange if according to <i>Money</i> variable of Murdock and Provost (1973): a) it "uses an indigenous currency in the form of metal coins of standard weight and fineness and/or their equivalent in paper currency"; b) it "uses indigenous articles of token or conventional value, such as cowrie shells, wampum, or imitation tools, as an elementary form of money"; c) it "lacks any forms of indigenous money but has long used the currency of an alien people" or d) "true money is lacking but the society employs domestically usable articles, such as salt, grain, livestock, or ornaments, as a medium of exchange". In contrast, a group is defined as lacking medium of exchange if it "lacks any recognized medium of exchange, conducting mercantile transactions through the direct or indirect exchange of goods, e.g., barter.
Note: For Writing, Meta a broader ethno-cu	al and Money variables the data are only available for 44 African ethnic groups, each representing altural province (Murdock 1968, Murdock and White 1969). We use this data to impute

Continued

the values for all groups in the corresponding cluster.

Data and Sources (continued)

Slavery	For each country measures the share of the non-European population that belongs to ethnic groups that had slavery in precolonial times. An ethnic group is defined as having slavery if according to Murdock's (1967) <i>Slavery</i> variable it had: a) "hereditary slavery present and of at least modest social significance"; b) "slavery reported but not identified as hereditary or nonhereditary" or c) "incipient or nonhereditary slavery, i.e, where slave status is temporary and not transmitted to the children of slaves". In contrast, a group is defined as not having slavery if it is characterized by "absence or near absence of slavery".
Permanent settlements	For each country measures the share of the non-European population that belongs to ethnic groups that indigenously have "permanent settlements". Scale is 0 to 1. An ethnic group is defined as having "permanent settlements" if according to Murdock's (1967) <i>Settlement Pattern</i> variable it is characterized by one of the following: a) "complex settlements consisting of a nucleated village or town with outlying homesteads or satellite hamlets"; b) "compact and relatively permanent settlements, i.e. nucleated villages or towns"; c) "separated hamlets where several such form more or less permanent single community" or d) "neighborhoods of dispersed family homesteads". In contrast, "nomadic" groups are described by the same variable as either: a) "fully migratory or nomadic bands"; b) "seminomadic communities whose members wander in bands for at least half of the year but occupy a fixed settlement at some season or seasons"; c) "semisedentary communities whose members shift from one to another fixed settlement at different seasons or who occupy more or less permanently a single settlement from which a substantial proportion of the population departs seasonally to occupy shifting camps" or d) having "compact but impermanent settlements, i.e. villages whose location is shifted every few years". Source: Constructed by the authors using Murdock (1967) and Atlas Narodov Mira (1964).
Dependence on agriculture	For each country measures a weighted average of "dependence on agriculture" of its ethnic groups. "Dependence on agriculture" for each group is from Murdock's (1967) <i>Subsistence Economy</i> variable and is relative to its dependence on hunting-gathering, fishing and animal husbandry. Scale is from 1 to 10. Source: Constructed by the authors using Murdock (1967) and Atlas Narodov Mira (1964).
Water area	Water area (km sq) divided by land area (km sq). Land area is a country's total area, excluding area under inland water bodies. In most cases the definition of inland water bodies includes major rivers and lakes. Source: Based on Parker (1997) and World Bank World Development Indicators (2003).
Land usage shares	Identify the percentage of the land of each country that belongs to the four types of land usage: (1) Arable, (2) Permanent crops, (3) Meadows and pastures and (4) Forest and woodland. The residual is called "Other land usage". The numbers are in percent (scale from 0 to 100). Source: Parker (1997).

Continued

Climate types	Climate types are tropical wet, tropical monsoon, tropical wet and dry, steppe (low latitude), desert (low latitude), subtropical humid, dry steppe wasteland and highland. Source: Parker (1997).				
Latitude	The absolute value of the latitude of the country, scaled to take values between 0 and 1. Source: La Porta et al (1999), originally based on CIA World Factbook (1996).				
Average elevation	Average elevation (th m). Source: Parker (1997).				

Colonial and postcolonial controls

% of European descent in 1960	% of population of European descent in 1960. "European" includes all whites. Scale from 0 to 1. Source: Morrison et al. (1989).						
English legal origin	Dummy variable taking value 1 for countries with English legal origin, 0 otherwise. Source: La Porta et al. (1999), originally based on "Foreign Laws: Current Sources of Basic Legislation in Jurisdictions of the World" (1989) and CIA World Factbook (1996).						
Religion shares	Identify the percentage of the population of each country that belonged to the three most widely spread religions in the world in 1980. The numbers are in percent (scale from 0 to 100). The three religions identified are Roman Catholic, Protestant and Muslim. The residual is called "other religions". Source: La Porta et al. (1999), originally based on Barrett (1982), Worldmark Encyclopedia of Nations (1995), Statistical Abstract of the World (1995), United Nations (1995), CIA (1996).						
Civil wars in 1970-1992	Percent of years for the period 1970-1992 in which a country experienced civil war. Scale from 0 to 1. Source: Bates (2003), originally from Singer (1994).						
Democracy in 1970-1994	Average of democracy for the years 1970-1994. Democracy is measured on an eleven-category scale, from 0 to 10, with a higher score indicating more democracy. Points are awarded on three dimensions: competitiveness of political participation (from 1 to 3); competitiveness of executive recruitment (from 1 to 2, with a bonus of 1 point if there is an election); and constraints on chief executive (from 1 to 4). Source: Polity III dataset.						
Constraints on the executive in 1970-1994	Average of constraints on the executive for the years 1970-1994. Constraints on the executive are measured on a seven-category scale, from 1 to 7, with a higher score indicating more constraints. Score of 1 indicates unlimited authority; score of 3 indicates slight to moderate limitations; score of 5 indicates substantial limitations; score of 7 indicates executive parity or subordination. Scores of 2, 4 and 6 indicate intermediate values. Source: Polity III dataset.						
Ethnolinguistic fractionalization	Average value of five different indices of ethnolinguistic fractionalization. Its value ranges from 0 to 1. Source: La Porta et al. (1999), originally from Easterly and Levine (1997).						

Appendix 2

Table A1: Precolonial political centralization in Sub-Saharan Africa

(Share of the Non-European population that had centralized political institutions before colonization)

Country	Centralization	Country	Centralization	
Comoros	1	Niger	0.582	
Lesotho	1	Sudan	0.576	
Swaziland	1	Congo Rep	0.536	
Burundi	0.995	Madagascar	0.505	
Rwanda	0.982	Nigeria	0.478	
Zimbabwe	0.965	Gambia	0.426	
Botswana	0.893	Guinea	0.406	
Malawi	0.861	Chad	0.384	
Mauritania	0.858	Burkina Faso	0.338	
Mozambique	0.844	Cameroon	0.316	
Ethiopia	0.843	Guinea-Bissau	0.214	
Zambia	0.743	Equatorial Guinea	0.211	
Benin	0.695	Kenya	0.172	
Senegal	0.694	Central African Republic	0.144	
Tanzania	0.669	Djibouti	0.133	
Namibia	0.664	Mali	0.115	
Ghana	0.651	Cote d'Ivoire	0.082	
Congo Dem Rep	0.649	Somalia	0.034	
Angola	0.635	Gabon	0.011	
Uganda	0.634	Sierra Leone	0.008	
Togo	0.622	Liberia	0	

Variable Obs Mean Std. Dev. Min Max Dependent variables % of roads paved in 1990-2000 40 18.528 14.018 0.8 73.763 % of infants immunized for DPT in 2001 42 23 96 57.881 20.403 Infant mortality in 1960-2001 42 195.389 127.658 31.405 73.856 Adult illiteracy rate in 1970-2002 37 56.062 17.893 24.377 89.561 School attainment in 1960-1990 26 1.918 1.1 0.467 5.015 Main independent variables Centralization 42 0.537 0.321 0 1 Centralized & Stratified 42 0.468 0.325 0 1 Centralized & Egalitarian 42 0.069 0.168 0 0.756 Fragmented & Stratified 42 0.085 0.144 0 0.509 Fragmented & Egalitarian 42 0.378 0.318 0 1 Log of GDP/cap in 1960 40 6.559 0.456 5.549 7.49 Log of GDP/cap in 1970 41 6.751 0.567 5.69 8.217 Log of GDP/cap in 1986 42 6.758 0.544 5.743 8.302 Log of GDP/cap in 2001 41 6.027 0.873 4.459 8.384 "Advancement" controls Population density in 1960 42 20.163 26.175 0.753 114.525 Population density per arable land in 1960 41 197.614 112.153 59.783 617.5 % of urban population in 1960 42 12.843 9.643 49.6 1.8 1 Landlocked dummy 42 0.333 0.477 0 Inland waterways 40 0.003 0.007 0 0.04 Writing 42 0.181 0.312 0 1 1 Metal 42 0.902 0.194 0.109 42 1 Money 0.774 0.286 0.011 42 0.85 0 Slavery 0.277 1 1 Permanent settlements 42 0.852 0.261 0.036 7.38 Dependence on agriculture 42 5.399 1.242 1.195 Water area 42 0.043 0.068 0 0.289 Latitude 42 0.125 0.08 0 0.326 42 Average elevation 0.486 0.605 0.002 2.14 Colonial and postcolonial controls % of European descent in 1960 0.014 0.001 41 0.03 0.141 English legal origin 0.405 0.497 1 42 0 Catholics 42 23.457 22.22 0 78.3 Muslims 42 31.536 34.802 0 99.8 42 13.812 14.886 64.2 Protestants 0 Other religions 42 31.195 19.736 64.1 0.1 Civil wars in 1970-92 42 0.095 0.196 0 0.783 Democracy in 1970-94 40 1.233 2.48 10 0 Constraints on the executive in 1970-94 40 2.458 1.548 1 7

Table A2: Summary statistics

Ethnolinguistic fractionalization

42

0.639

0.271

0

1

Table A3: Pairwise correlations of dependent variables

		% of infants			
	% of roads paved	immunized for DPT	Infant mortality	Adult illiteracy rate	School attainment
	in 1990-2000	in 2001	in 1960-2001	in 1970-2002	in 1960-1990
% of roads payed in 1990-2000	1				
// 0110000 pulle	(40)				
% of infants immunized for DPT in 2001	0.357**	1			
	(40)	(42)			
Infant mortality in 1960-2001	-0.332**	-0.309**	1		
	(40)	(42)	(42)		
Adult illiteracy rate in 1970-2002	-0.268	-0.335**	0.726***	1	
	(35)	(37)	(37)	(37)	
School attainment in 1960-1990	0.181	0.213	-0.576***	-0.78***	1
	(25)	(26)	(26)	(25)	(26)

Notes:

(1) *** denotes significance at the 1% level, ** at the 5% level, * at the 10% level.

(2) Number of observations is shown in parentheses.

	Precolonial political institutions				
		Centr	Centr	Fragm	Fragm
	Centra-	&	&	&	&
	lization	Strat	Egalit	Strat	Egalit
Income					
Log of GDP/cap in 1960	-0.21	-0.128	-0.145	-0.021	0.226
Log of GDP/cap in 1970	-0.203	-0.14	-0.114	-0.114	0.259
Log of GDP/cap in 1986	-0.068	0.049	-0.225	-0.183	0.152
Log of GDP/cap in 2001	-0.044	0.117	-0.301*	-0.212	0.144
"Advancement" controls					
Population density in 1960	0.414***	0.444***	-0.067	-0.097	-0.375**
Population density per arable land in 1960	-0.028	0.07	-0.186	0.099	-0.017
% of urban population in 1960	-0.453***	-0.326**	-0.236	-0.043	0.477***
Landlocked dummy	0.336**	0.263*	0.135	-0.085	-0.301*
Inland waterways	-0.144	-0.118	-0.049	0.444***	-0.058
Writing	-0.168	-0.216	0.097	0.142	0.105
Metal	-0.254	-0.304*	0.102	-0.083	0.295*
Money	-0.332**	-0.082	-0.476***	-0.199	0.426***
Slavery	-0.185	-0.232	0.094	0.263*	0.068
Permanent settlements	0.141	0.195	-0.107	0.001	-0.143
Dependence on agriculture	0.033	0.035	-0.004	0.087	-0.073
Water area	0.003	-0.152	0.299*	-0.011	0.002
Latitude	0.386**	0.306**	0.147	0.203	-0.482***
Average elevation	0.508***	0.48***	0.044	-0.152	-0.444***
Colonial and postcolonial controls					
% of European descent in 1960	-0.048	0.009	-0.106	-0.176	0.129
English legal origin	0.098	0.036	0.116	-0.087	-0.059
Catholics	0.134	0.171	-0.075	-0.39**	0.041
Muslims	-0.193	-0.221	0.059	0.426***	0.002
Protestants	0.171	0.168	0.001	-0.309**	-0.032
Other religions	0.061	0.071	-0.021	-0.079	-0.026
Civil wars in 1970-92	0.083	-0.036	0.227	-0.224	0.018
Democracy in 1970-94	0.187	0.244	-0.116	0.135	-0.257
Constraints on the executive in 1970-94	0.164	0.208	-0.091	0.193	-0.26
Ethnolinguistic fractionalization	-0.363**	-0.403***	0.084	0.046	0.346**

Table A4: Pairwise correlations between precolonial political institutions and controls

Notes:

(1) *** denotes significance at the 1% level, ** at the 5% level, * at the 10% level.

	Centr	Centr	Fragm	Fragm		Centr	Centr	Fragm	Fragm
	&	&	&	&		&	&	&	&
Country	Strat	Egalit	Strat	Egalit	Country	Strat	Egalit	Strat	Egalit
A 1	0.625			0.265	T .1	- 1			
Angola	0.635	0	0	0.365	Lesotho	1	0	0	0
Benin	0.695	0	0.007	0.297	Liberia	0	0	0	1
Botswana	0.884	0.009	0	0.107	Madagascar	0.505	0	0.495	0
Burkina Faso	0.338	0	0.023	0.64	Malawi	0.105	0.756	0	0.139
Burundi	0.995	0	0	0.005	Mali	0.115	0	0.509	0.377
Cameroon	0.238	0.078	0.099	0.584	Mauritania	0.858	0	0.142	0
Central African Republic	0.144	0	0	0.856	Mozambique	0.318	0.526	0	0.156
Chad	0.384	0	0.098	0.518	Namibia	0.664	0	0	0.336
Comoros	0.983	0.017	0	0	Niger	0.135	0.447	0.286	0.132
Congo Dem Rep	0.559	0.09	0.012	0.34	Nigeria	0.466	0.012	0.052	0.47
Congo Rep	0.536	0	0	0.464	Rwanda	0.982	0	0	0.018
Cote d'Ivoire	0.082	0	0.026	0.893	Senegal	0.694	0	0.238	0.068
Djibouti	0.133	0	0	0.867	Sierra Leone	0.008	0	0.37	0.622
Equatorial Guinea	0.211	0	0	0.789	Somalia	0.034	0	0	0.966
Ethiopia	0.727	0.116	0.052	0.104	Sudan	0.083	0.494	0.047	0.376
Gabon	0.011	0	0	0.989	Swaziland	1	0	0	0
Gambia	0.426	0	0.462	0.112	Tanzania	0.591	0.078	0.091	0.24
Ghana	0.651	0	0.133	0.216	Togo	0.564	0.058	0	0.378
Guinea	0.406	0	0.259	0.335	Uganda	0.633	0.001	0.033	0.333
Guinea-Bissau	0.214	0	0.132	0.654	Zambia	0.56	0.184	0	0.257
Kenya	0.146	0.027	0	0.828	Zimbabwe	0.95	0.015	0	0.035

Table A5: Precolonial centralization and class stratification in Sub-Saharan Africa
Appendix 3

Proof of Proposition 1. In stratified societies, s=0 and provision is $(g_1 = 0, g_2 = 0)$ irrespective of k. In egalitarian districts, s = 1 and there are two cases. If k=1/2, Assumption 1 implies that in equilibrium $(g_1 = 0, g_2 = 0)$. If k=0, then C < 1 implies that in equilibrium $(g_1 = 1, g_2 = 1)$.

Proof of Proposition 2. General remark: we solve for the equilibrium of the model by iteratively deleting weakly dominated strategies. The chief of district *i* proposes a plan (g_i^i, g_{-i}^i) maximizing its payoff given the plan proposed by the chief of district *-i*. Let us first consider stratified societies.

<u>Stratified societies (s=0)</u>. There are two cases to study. 1. *No Spillovers (k=0)*. Since $\pi > C$, it is easily found that $(g_i^i = 1, g_{-i}^i = 1)$ is an equilibrium. Is it unique? It can be seen that the chief of district *i* weakly prefers $(g_i^i = 0, g_{-i}^i = 1)$ to $(g_i^i = 0, g_{-i}^i = 0)$ and $(g_i^i = 1, g_{-i}^i = 1)$ to $(g_i^i = 1, g_{-i}^i = 0)$. Thus, the game between the chiefs of districts 1 and 2 reduces to:

Chief 1\Chief 2	(0,1)	(1,1)
(0,1)	$\pi/2, \pi/2$	$-C$, $\pi-C$
(1,1)	$\pi - C$, $-C$	$\pi/2-C$, $\pi/2-C$

It can be seen that, under A.2, $(g_i^i = 1, g_{-i}^i = 1)$ is the unique equilibrium of the game. Thus, the equilibrium provision of "no spillovers" good in stratified societies is $(g_1 = 1, g_2 = 1)$.

2. Large spillovers (k=1/2). Again, $(g_i^i = 1, g_{-i}^i = 1)$ is an equilibrium. Is such equilibrium unique? It is easily seen that also in this case, we can eliminate (1,0) and (0,0) through iterated deletion of weakly dominated strategies. Hence, the game is the same as that depicted above and

the same conclusion follows: under A.2, for k=1/2 in stratified societies $(g_1 = 1, g_2 = 1)$ in equilibrium.

Egalitarian societies (s=1). Now political competition only requires the *Elite* (i.e. the whole local population) to participate. Once again, consider two cases. 1. *No spillovers* (k=0). As in Proposition 1, in equilibrium it must be that $g_1 = g_2 = 1$. 2. Large *spillovers* (k=1/2). It is immediate to see that assumption A.1 implies that $(g_i^i = 1, g_{-i}^i = 1)$ is a dominant strategy. Thus, in equilibrium it must also be that $g_1 = g_2 = 1$.