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State Capacity and Violence: Evidence from the Rwandan genocide*

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Abstract

Exploiting local variation in state capacity within Rwanda I investigate the link between state capacity and violence. Using a disaggregated measure of the intensity of the 1994 Rwandan genocide, I establish that greater local state capacity led to greater conflict intensity. I proxy modern state capacity with its precolonial counterpart, measured by the total time a district was incorporated in the precolonial kingdom. This 'duration of incorporation' measures the cumulative effect of the centralizing forces in the kingdom and acts as a proxy for state capacity. Since the kingdom expanded through conquest and consolidated through patronage relations revolving around cattle, I instrument the duration of incorporation with the geographical suitability for cattle. This strategy confirms the main result. State capacity, while usually associated with greater public good provision and higher GDP, played a central role in the mass killings in Rwanda.

Keywords: State capacity, violence, Rwanda.
JEL classification: O10, A10, N4.

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1 Introduction

The absence of a centralized or strong state that is able to enforce property rights, raise taxes and provide public goods obstructs development and breeds conflict (Fearon and Laitin, 2003; Besley and Persson, 2010; Acemoglu et al., 2010; Herbst, 2000). Several measures of the capacity to carry out these tasks, such as tax revenue as percentage of GDP, correlate strongly with measures of economic development such as GDP and constraints on the executive (Besley and Persson, 2011; Acemoglu, 2005). Furthermore, research on the relationship between African precolonial political centralization and modern development outcomes has shown that the positive impact of a well-functioning state persists (Gennaioli and Rainer, 2007; Michalopoulos and Papaioannou, 2013; Osafo-Kwaako and Robinson, 2013).

At the same time, there are reasons to believe that state capacity can be abused. Regimes predating on their population can use a well-functioning state apparatus to their advantage in the same way as more benevolent governments. Over the last two centuries, 71 percent of all mass killings of citizens by their own governments were perpetrated by three strong states, Germany, Russia/USSR and China (Easterly et al., 2006). Over the twentieth century, this percentage rises to around 80 percent (Rummel, 1998). Compulsory sterilization has been more widespread in more developed countries, from the United States or the United Kingdom in the early twentieth century (Barkan, 1992) to China more recently as part of its one-child policy (Gewirtz, 1994)[1].

In this paper, I investigate the effects of high state capacity in a country that has recently seen both state-led development as well as state-led repression: Rwanda. Rwanda's rapid economic growth in the second half of the twentieth century has repeatedly been attributed to the activist government that promoted the cultivation of cash crops for the international market, assured peace, and built extensive roads and irrigation works (Verwimp, 2013). Yet in 1994 the same state was heavily involved in the catastrophic Rwandan genocide (Mamdani, 2002; Des Forges, 1999) during which extremist Hutus killed around 800,000 Tutsis and moderate Hutus (Verpoorten, 2005; Prunier, 1995). I explore this apparent contradiction by investigating whether greater local state capacity led to more violence during the genocide.

After the genocide, the Rwandan government initiated a transitional justice program to resolve grievances and judge perpetrators. Central to this policy was a system of over 8000 Gacaca courts, trying alleged

[1]Similarly, the wide-spread censorship (King et al., 2012) in China requires a substantial organizational effort.

perpetrators. I use data from these Gacaca courts to reconstruct a measure of the local intensity of the genocide (Verpoorten, 2011; Yanagizawa-Drott, 2010). To measure local state capacity I use the idea that a strong state is built up over time by concscious investment (Besley and Persson, 2009a) or endogenous evolution (Tilly, 1992). I document the expansion of the precolonial Nyiginya recording the total time a subnational district was part of the precolonial kingdom, which I term the 'duration of incorporation'. This duration of incorporation measures the cumulative effect of the centralizing forces in the Nyiginya kingdom and proxies for precolonial state capacity which, in turn, proxies for modern state capacity. This measure can be viewed as a subnational within-ethnicity extension of the state antiquity measures used by Bockstette et al. (2002)[2] and Depetris-Chauvin (2013). I show that the duration of incorporation correlates with modern measures of state capacity as well as GDP. My baseline estimates correlate the duration of incorporation with the intensity of the violence in the genocide.

Exploiting this novel way of measuring within-ethnicity state capacity I establish a positive, significant and robust correlation between state capacity and the intensity of the genocide. Districts that had a more efficient state apparatus were better able to coordinate the genocide efforts.

The timing of incorporation of a district into the Nyiginya kingdom is not assigned randomly. I construct two instruments for the duration of incorporation, one based on the geographic attractiveness of a place for incorporation, measured by the suitability for keeping cattle and one based on the expansion of the kingdom. In the Nyiginya kingdom, cattle was a source of food as well as the preferred mode of storing wealth. Furthermore, the social institutions of the Nyiginya kingom revolved around the lending of cattle by a patron in return for services rendered by a client. This, I argue, creates a source of exogenous variation in the timing of the incorporation of a precolonial district[3] and, hence, a source of exogenous variation in state capacity. The suitability for keeping cattle is correlated with the historical expansion of the kingdom but can be excluded from a specification linking state capacity to the intensity of violence in the genocide. Cattle had lost its pivotal position in Rwandan society by the end of the twentieth century. By 1980 most pasture land in Rwandan had been converted to arable land, so that suitability for pasture is unlikely to enter individual's decisions of whether to engage in genocide. As an alternative strategy, I use the distance from the mythological site, called Gasabo hill, from which the Nyiginya kingdom is said

[2]Bockstette et al. (2002) show that having a form of political centralization earlier, and therefore a longer time accumulating state capacity, correlates with development outcomes just like a measure of (the stock of) modern state capacity, such as the share of tax revenue in GDP, does.

[3]Since the whole kingdom became part of the German colonial possessions at the same time, all variation in the total duration of incorporation comes from the initial year of incorporation.

to have started expanding as an instrument for the duration of incorporation. GMM estimates using a cattle suitability index or the distance from Gasabo hill as an instrument for the duration of incorporation confirm the earlier OLS results. Greater local state capacity is associated with greater violence in the genocide. Furthermore, the first stage has the predicted sign. Better suitability for keeping cattle or closer proximity to Gasabo predicts earlier incorporation into the Nyiginya kingdom. I corroborate the excludability of cattle suitability by showing that the results are robust to including several measures of wealth and general agricultural suitability. Using the point estimates from the most demanding GMM regression I show that 150 extra years of state history (going from the 25th to the 75th percentile) gives rise to an eight percentage point increase in genocide violence.

The positive association between state capacity and violence can thus be interpreted as causal. I also show that the result is robust to a wide range of alternative explanations for the local intensity of the genocide. In addition to these, I show that the result is robust to including a range of historical and geographical controls, several methods of aggregating the violence data, and several different specifications of the cattle suitability index. Finally, I provide tentative evidence that my the duration and incorporation and the violence intensity are not both outcomes of a spatial pattern emanating from Kigali, the capital of Rwanda.

I next turn to the persistence of historic state capacity. A simple falsification exercise shows that there is no correlation between the duration of incorporation and violence if the violence is not state organized. More specificallly, the duration of incorporation does not predict locations of violence in the 1959 coup nor does it predicts violence in post genocide Rwanda. These falsification results justify focusing on the persistence of state capacity as a channel connecting precolonial state capacity and violence intensity in the genocide. I show results that relate the duration of incorporation to measures of GDP and public goods from the colonial period and the period leading up to the genocide. The falsification and the persistence results show that precolonial state capacity persists. I briefly discuss factors that could drive this correlation, focusing on the question whether the institutions of local government or the human capital of the local office holders is the driving factor behind this persistence.

1.1 Related literature

This paper extends the literature by improving our understanding of the effects of state capacity on development outcomes, provides insight into the determinants of violence and extents understanding of the history of development in Rwanda.

1.1.1 State Capacity

A growing literature examines the determinants and the effects of state capacity. The work of Besley and Persson (2009a, 2010, 2011) shows how conflict and investments in state capacity are both determinants and outcomes of (future and past) state capacity. In cross-country data, measures of greater state capacity are correlated with higher GDP (Besley and Persson, 2011). An older literature established the correlation between variables such as such as property rights protection, the rule of law and GDP (Knack and Keefer, 1997; La Porta et al., 1999). Other work examines the effects of precolonial state capacity in Africa. Using anthropological measures of state centralization, these studies establish a correlation between precolonial state capacity and GDP (Michalopoulos and Papaioannou, 2013) as well as a correlation between precolonial state capacity and public good provision (Osafo-Kwaako and Robinson, 2013; Gennaioli and Rainer, 2007). I empirically test the relationship between state capacity and violence, contributing to the understanding of the full array of effects of state capacity. In this respect, my paper is related to the work by Fearon and Laitin (2003), who show that lower state capacity is correlated with more insurgency. Methodologically, my paper moves beyond these studies in considering local state capacity below the level of the ethnicity. My method of focusing on the precolonial kingdom to obtain a proxy for state capacity could be applied to other centralized precolonial polities as well. Finally, by showing that state capacity persists I contribute to a literature concerned with the persistence of historical institutions (Nunn, 2008, 2009; Dell, 2010). My finding that persistence is not influenced by a measure of colonial human capital provides some evidence on through what channels history matters for development outcomes today.

1.1.2 Violence

This paper contributes to the large literature on civil conflict, surveyed in Blattman and Miguel (2010), by showing how a strong state was significantly involved in genocidal violence. Smaller literatures look at different types of conflict, such as mass killings (Easterly et al., 2006) and one-sided violence or repression (Harff and Gurr, 1989; Collier and Rohner, 2008). Theoretical work by Besley and Persson (2009b) suggests that both forms of violence, one-sided repression or two-sided civil conflict, are more likely to occur when

states are weak. More broadly, all theoretical work on the relation between the strength of the state or state capacity and violence (Besley and Persson, 2009b, 2010; Acemoglu et al., 2010) points to a negative relationship; the weaker the state the more violence, one-sided or two-sided. This paper shows that this is not necessarily the case. The Rwandan case shows that state capacity can not only be used to wage war on people threatening the state but also to predate on the population. History is littered with examples of the state predating on the population (Acemoglu and Robinson, 2012). This paper shows one way how variation in success of this repression comes about.

The rest of this paper proceeds as follows. Section 2 gives an overview of the relevant episodes of Rwandan history. It establishes the validity of using the duration of incorporation of as a measure of precolonial state capacity. It also introduces the historical background for the use of the cattle suitability index. Finally, this section presents the regression specifications used in this paper. Section 3 presents OLS and GMM evidence for the baseline specification, the effect of the duration of incorporation on the intensity of violence in the genocide. Section 4 discusses threats to the identification strategy and robustness and presents some simple falsification exercises to justify the focus on persistent state capacity and the cattle suitability index. Section 5 concludes.

2 Historical state capacity, exogenous variation in state capacity, and regression specifications

This section introduces the relevant parts of Rwandan history and the main regression specifications. I first review the relevant elements of Rwandan history[4], especially the founding of the kingdom, the state organization of the genocide and the validity of using the duration of incorporation as a proxy for state capacity. I then present the reduced foms specification that regresses violence in the genocide on the duration of incorporation. Section 2.2. introduces the historical background for the cattle suitability index, which will serve as the main instrument in subsequent GMM specifications.

[4]This section draws heavily on the seminal work of Jan Vansina on precolonial Rwandan history (Vansina, 2004).

2.1 Historical Background

The precolonial Rwandan kingdom, named the Nyiginya kingdom after the dominant lineage, was founded in the sixteenth century by a king named Ndori[5]. Ndori took over a number of hills in a region called Busigi, about twenty to thirty miles northwest of the modern day capital Kigali. He was able to establish a small kingdom because he brought with him large herds of cattle with which he bought the loyalty of the local chiefs[6] (Vansina, 2004, p. 32). Until 1700, the kingdom remained relatively stable, and was confined to a small area in central Rwanda. From 1700 to 1900, Ndori's successors expanded the kingdom to beyond Rwanda's current borders.

2.1.1 The organization of state power

When Ndori founded the Nyiginya kingdom he introduced the *ubuhake* contract[7]. The *ubuhake* contracts were 'entered into' by a patron and his client[8]. The patron gave one or more head of cattle in usufruct to the client, but the patron maintained ownership. The client was then to effectively become a servant of the patron. The *ubuhake* contract tied people to the land. This is an important precondition for political centralization, the establishment of authority, and accumulation of state capacity (Herbst, 2000).

Ndori introduced the *ubuhake* contracts to tie his potential political adversaries to him. Vansina says about this: "to accept a contract of this sort was to submit to the king" (Vansina, 2004, p. 47). However, the contract was also an effective means of governing other economic relations. For instance, for poorer people, the prospect of having one or more cows for certain seems attractive. As society expanded and cattle contracts diffused throughout the kingdom, ever more cattle was needed to be distributed under the *ubuhake* contract. The kingdom continuously expanded in search of more cattle and more pasture (Vansina, 2004, p. 69). The king seized herds and with the herds came the hills and the pasture the herds grazed on. Hence as the kingdom expanded, the fraction of total land that was the king's domain increased disproportionally until, by the end of the eigteenth century all the land in the kingdom was owned by the king. This system of cattle contracts trickling down the entire domain of the king acted as a substitute bureaucracy. The king kept an extensive court and a hereditary standing army, all maintained with labour

[5]Earlier historiography, most notably the works by Alexis Kagame (Kagame, 1975), put the founding of the Rwandan kingdom in the eleventh century. Appendix 1 gives the list of kings, following Vansina, used in this paper.

[6]With respect to the balance of power within Rwanda, this can be viewed as an exogenous event. That is, the organizational capacity to expand was exogenously introduced from outside Rwanda.

[7]A more appropriate term would be *ubuhake* relationship as the contracts could not be formally enforced.

[8]This section, with the exception of specific references, is based on the seminal work of Vansina (2004).

requisitioned through the vasallage system.

2.1.2 Measuring precolonial state capacity

Ndori and his successors were able to operate a strong kingdom without the use of a formal administrative structure. However, hereditary conscription into the army and the *ubuhake* contracts formed a backbone to this kingdom strong enough to keep it together and well organized (Vansina, 2004, p. 61). Through these social instutions every newly raided hill became an integral part of the Nyiginya kingdom. It is this process that forms the basis of the justification of the use of the duration of incorporation as a measure of precolonial state capacity. Since annexation was slow, the duration of incorporation measures the cumulative effect of this process. Regions that were in the precolonial kingdom longer will have more state capacity than regions that were in the precolonial kingdom for a shorter period of time.[9] In fact, Newbury (1988) (cited in Verwimp (2013)) shows that in the parts of Rwanda that were incorporated latest, people feel much less inclined to obey central authority. Reluctance to pay taxes and to submit to control was much larger in areas of Rwanda that were incorporated towards the end of the nineteenth century, such as Ruhengeri, than in the parts of Rwanda that were incorporated earlier.

Below I demonstrate that state capacity measured by the duration of incorporation proxies for modern state capacity. Therefore, results derived using precolonial state capacity are informative about the contemporary relation between state capacity and conflict. This way of measuring precolonial state capacity is, to the best of my knowledge, the first attempt at measuring within country, within ethnicity, historical state capacity. Previous research relies on anthropological measures of state centralization at the ethnicity level (Gennaioli and Rainer, 2007; Osafo-Kwaako and Robinson, 2013; Michalopoulos and Papaioannou, 2013). Although the structure of the Nyiginya kingdom is specific to Rwanda, applying this methodology to other centralized precolonial states that expanded by conquering, such as Buganda or the Ashanti empire would be instructive.

[9] When the Nyiginya kingdom became part of the German colonial possessions, the central part of Rwanda had a history of central rule for at least two centuries. It also contained the royal palace at Nyanza. Other parts of modern Rwanda, such as the far north, were just incorporated at the time of colonization. The central part of the country did not keep its political prominence however. When Habyariama was in power, his native prefecture of Gisenyi, in the far northwest of the country, provided between a third and a half of the important political posts (Mamdani, 2002, p. 151). This shift in the political center of gravity indicates that the duration of incorporation is not just identifying the later political center of Rwanda instead of state capacity.

2.1.3 The persistence of state capacity

Having been a German colony for twenty years, Rwanda passed to the Belgians after World War I. The Belgians kept the local administrative structure intact, but replaced all Hutu chiefs by Tutsis and transferred power from the king to the local authorities[10]. By increasing their power, the local chiefs became the mechanism by which the Belgians requisitioned labour. In turn, the local chiefs used the pre-existing power and patronage structures to organize labour. As a result, the Belgians created a very powerful class of local chiefs (Mamdani, 2002, p. 91). After the 1959 revolution, in which Hutus killed around 100,000 Tutsis and ousted the king, Rwanda gained independence from Belgium in 1962, becoming a Hutu dominated republic. The new Hutu leadership again kept the local power structures intact, but replaced all lower level Tutsi chiefs by Hutus[11]. This transition kept the extensive colonial system of government control and labour requisitioning firmly intact (Hintjens, 1999). Indeed, when Habyarimana took office, a forced labour system, now called *umuganda*, was introduced. It was organized, as in the Nyiginya kingdom and under colonialism, through the local chiefs[12]. Habyarimana argued that an *umuganda*-like system had always been part of Rwandan culture and tradition (Verwimp, 2013, p. 39). Local (*commune*) governments kept accounts of participation and achievements of the *umuganda* and the targets for the next session were announced at the Sunday mass in church (Ibid., p. 59). Section 5 formally shows that state capacity persist through the colonial period and investigates some of the determinants of differing degrees of persistence.

2.1.4 The genocide

Following the 1959 revolution, many Tutsi fled to Uganda. In 1987 they formed the Rwanda Patriotic Front and in 1990 they invaded northwest Rwanda. In response, radical Hutus started arming the population[13], forming civilian defence forces and youth militias, the *Interahamwe* and *Impuzamugambi*. Radical Hutus also started a propaganda offensive (Yanagizawa-Drott, 2010), arousing fear for Tutsi retaliation for the 1959 coup and enlisting Hutu support for an ever more radical response to the Tutsi invasion (Mamdani, 2002, p. 190). When the peace talks in Arusha seemed to end in a shared power agreement, radical Hutus felt their power threatened (Verwimp, 2013; Bates, 2008). When the plane of Rwanda's president Habyarimana was shot down, they jumpstarted Rwandan genocide. Estimates vary, but around 800,000 Tutsis

[10] The Nyiginya kingdom had local 'chiefs of the land', usually Hutu, 'chiefs of the people', usually Tutsi and 'chiefs of the pasture, always Tutsi. The Belgians merged these functions into one (Mamdani, 2002, p. 90).

[11] At higher administrative levels Tutsis were allowed to hold office.

[12] Even today, the *umuganda* system is still in operation in Rwanda. It now takes the form of monthly mandatory community service, and is still called *umuganda*, see f.i. http://www.newtimes.co.rw/news/index.php?i=15278&a=13411, accessed 04-27-2013.

[13] Between 1989 and 1992 military spending increased from 1.9 to 7.8 percent of GDP (Mamdani, 2002, p. 148).

and moderate Hutu are said to have perished[14] (Verpoorten, 2005; Prunier, 1995). The genocide ended when the RPF conquered the capital, Kigali.

2.2 The role of the central and local government in the genocide

The Rwandan state of the second half of the twentieth century functioned extraordinarily well[15]. It had, for example, detailed administrative systems registering births and deaths as well as a racial identity card system[16]. It had a parallel organization of party and state at every level of government. It mobilized the entire population into *umuganda* forced labour sessions, as well as frequent animation ceremonies to honour the president. The state drew up and executed detailed five year plans for agricultural production, which involved forced resettlement schemes and forced cultivation of export crops. These plans were monitored by so-called agricultural monitors who kept track of production (1 for every 120 people where export crops were grown, 1 for every 750 everywhere else). Public decency was enforced, with the police closing bars at twelve o'clock at night. This capacity was crucial when it came to organzing the genocide. Alison Des Forges describes: "Orders from the prime minister were handed down to the prefect, who passed them on to the burgomasters[17], who called local meetings throughout the communes where they read the instructions to the populations" and "reports on the situation at the local level and minutes of meetings held by people out on the hills were handed back up through the administrative channels' '(Des Forges, 1999, p. 8).

The execution of the genocide was organized locally. For instance, a journalist recalls a meeting in 1991 in which it was decided that a death squad needed to be formed to kill some 300 Tutsi. Although the meeting was presided over by president Habyarimana, the execution was left to the burgomasters, who were instructed to find 'trustworthy people' to do the job (Verwimp, 2013, p.131). After these initial massacres, elaborate training programs were set up in each commune (that is, they were decentralized, or local) to train the youth to fight with 'traditional weapons', i.e. machetes. One person in ten would be trained while living at home, under the pretense of self defence. Coordination of these activities was left to sector councillors and the local police (Ibid. p. 147). In early 1994, just before the genocide, the government ordered the local governments to supply a list of potential reliable people and reservists. A

[14]The genocide was organized largely, though not strictly, along ethnic lines (many moderate Hutus were also killed). The ethnic division between Hutus and Tutsi was not, however, a racial or genetic division. Web appendix 1 discusses traces these ethnic categories over time and provides the relevant background to the discussion in this paper.

[15]If not otherwise cited, the examples in this section are drawn from Verwimp (2013).

[16]In contrast, neighbouring Congo and Uganda were disintegrating under the regimes of Mobutu and Amin

[17]The burgomasters were the administrators of the *communes*. Footnote added by me.

day later, a list of useful people was handed out to every sector, detailing those who would be eager to join the genocide. At the same time, the sectors were responsible for identifying the targets for the genocide as well as computing the required number of machetes and firearms (Ibid. p. 148).

When the genocide started, the local chiefs became instrumental, promising spoils to impoverished Hutus (Mamdani, 2002, p. 201) and forming squads to seek out the targeted Tutsis. The tactical knowledge of the military was used to direct and expediate the killings that were carried out by the ordinary Rwandans (Des Forges, 1999, p.8 and passim), who were requisitioned much like in colonial times. In fact, In line with the long tradition of compulsory labour for the state, some ringleaders in the genocide referred to the killings as a duty, a corve, that was to be performed for the state (Des Forges, 1999, p. 8). One eye-witness reported that a certain chief organized a band of Hutus to bring their machetes to clear a plot of forest, only to send them to kill Tutsis instead (Mamdani, 2002, p. 194). Killing men came to be known as 'bush clearing' and killing women and children was known as 'pulling out the roots of the bad weeds'. Although the genocide was centrally planned, it was locally executed. I therefore argue that local variation in state capacity can plausibly be linked to local variation in genocide intensity.

2.3 Summary

The preceding historical sections have shown that the duration of incorporation can be used as a proxy for precolonial state capacity and that state capacity was instrumental in the organization of the genocide. The next section describes the construction of the database and the main OLS specification used to test the hypothesis that modern state capacity, proxied by precolonial state capacity, predicts violence intensity.

2.4 Data and OLS specification

The main explanatory variable, the duration of incorporation, is constructed by subtracting the year of incorporation of sector i from 1897, the year of the German conquest. By combining maps from Belgian colonial sources (Paternostre de La Mairieu, 1972; Belgium, 1952) maps of the Nyiginya kingdom and the historical evidence in Vansina (2004), I reconstructed the administrative structure of the Nyiginya kingdom[18]. For each district I then identified the year of its incorporation into the kingdom to arrive at the duration of incorporation. Figure 1 contains a map of the expansion of the precolonial kingdom. The

[18]The web appendix outlines the exact procedure I followed to reconstruct the administrative structure of the Nyiginya kingdom

middle map shows the precolonial district and the color indicates the range of years in which the year of incorporation falls. The top map displays the intensity of violence in the genocide (discussed below). A darker shade means more violence.

[insert figure 1 about here]

My main dependent variable is violence in the 1994 genocide as recorded in the National Service of Gacaca Jurisdictions court proceedings (Verpoorten, 2011). These courts were instituted to try people suspected of participating in the genocide. The data consist of three categories of violence for which people were prosecuted[19]:

1. Planners, organizers and supervisors of the genocide. This includes organizers at the local bureaucratic level and within political parties as well as the youth militias.
2. Civilian violence, homicides and serious physical violence.
3. Violence against property, if not amicably settled.

This violence data is a proxy of the intensity of the genocide. However, as long as there is no systematic correlation between the measurement error introduced by using the Gacaca proxy and a possible omitted variable, this deviation is subsumed in the error term. I use the sum of the number of convicts in each category, normalized by the population from the 1991 census, as my main dependent variable[20]. These data are used to run the following specification[21]:

$$Violence_{id} = \beta_1 Duration_{id} + \boldsymbol{z'_{id}}\boldsymbol{\beta_2} + \boldsymbol{q'_{id}}\boldsymbol{\beta_3} + \boldsymbol{r_d} + \varepsilon_{id} \quad (1)$$

$Violence_{id}$ is the number of prosections per capita in sector i in modern district d. $Duration_{id}$ is the duration of incorporation defined as $(1897 - x_{id})$ where x_{id} is the year of incorporation in the Nyiginya kingdom for sector i in modern district d, making $(1897 - x_{id})$ the natural measure of duration of incorporation. $\boldsymbol{z_{id}}$ is a vector of historical and contemporary controls. In the specifications used in table 2, this

[19]The data have been generously made available by David Yanagizawa-Drott who is, as far as I am aware, the only other person to have used (Yanagizawa-Drott, 2010) them in the context of measuring local violence in the genocide. The website of the Gacaca system, http://www.inkiko-gacaca.gov.rw/En/EnLaw.htm, where the data were originally published is no longer operational (March 1st, 2013).

[20]The data for the 1991 census is available at the commune level, one level above the sector, my main unit of observation, see web appendix 1 for the sources and units of observation.

[21]In appendix 1, figure A1-2, I provide non-parametric LOWESS estimates of the relationship between the duration of incorporation and violence as well as between the predicted values of the duration of incorporation from the first stage (see below) on violence. Both estimates point to a linear model as the best approximation the relationships in the data. For the predicted values relationship, a formal Box-Cox test fails to reject a linear model (p-value: 0.174).

vector includes distance to Kigali, measured from the centroid of each sector, and the percentage Tutsi from the 1991 census. $\boldsymbol{q_{id}}$ is a vector of geographical and distance covariates. $\boldsymbol{r_d}$ is a vector of modern district level fixed effects. ε_{id} is the error term. Results are reported below, in section 3.

2.5 Exogenous variation in the precolonial state capacity and IV specification

I have illustrated the importance of cattle in the Nyiginya kingdom, in its function as a store of wealth as well as the basis of the *ubuhake* contracts. When expanding, the Nyiginya kings therefore chose places that were more suitable for keeping cattle. The "primary goal [of expansion] was to raid cattle" (Vansina, 2004, p. 50). Ndori and the later kings were "looking primarily for herds" (Ibid.) and "their preferred victims were herders" (Ibid.). It is therefore plausible that expansion was more succesful in areas that are more suitable for cattle. Indeed, (Vansina, 2004, p. 47) notes: "Thus the cow as much as the bow and the spear founded the Nyiginya kingdom". These observations form the basis of my instrument: the cattle suitability index. The index is composed of a measure of the suitability of the TseTse, a measure of the suitability for pasture and a terrain slope measure[22]. The bottom panel of table 1 gives summary statistics for the components of the index and the bottom map in figure 1 shows the geographical variation in the index. After having rescaled all variables to lie between 0 and 1, the index is the product of these three factors[23]. The index captures exogenous, geographic, factors that influence the suitability for cattle keeping of a certain part of the country and, therefore, it introduces variation in the year of incorporation of this part of the country and hence, in the duration of incorporation.

TseTse is a major factor in the suitability for cattle to survive in Africa (Maudlin, 2006) and is known to be a factor in Rwanda especially in the North-Eastern part of the country (Vansina, 2004, p. 15). The suitability for pasture is important for several reasons. As pointed out above, the possession of a herd entitled the owner to a plot of pasture and the hill this was on. Since the king required increasing numbers of cattle to keep his political vassals dependent on him he was in ever more need of pasture. Furthermore, the herds that were private possessions of the king needed pasture land. Finally, population growth increases demand for pasture land. Ganskopp et al. (2007) argue that livestock generally does not graze on slopes above ten degrees. In my dataset slope varies between zero and fifteen degrees, so I include this variable in the index.

[22]Rwanda is unsuitable for other TseTse subspecies, such as the forest TseTse. For a full description of this variable, a description of the construction of the index, as well as the sources for the all three variables, see web appendix 1.

[23]Table A2-3 in the web appendix shows that the results are robust to several functional forms of the cattle suitability index. That is, summing the factors, taking a weighted average or defining cutoffs for the components and creating a dummy instrument do not significantly change the results.

An alternative strategy is to directly exploit the spatial expansion of the kingdom. The Nyiginya kingdom is said to have expanded from the site of the mythical Gasabo hill. I therefore instrument forthe duration of incorporation with the distance to Gasabo hill. The main threat to the exclusion restriction for this instrument is that Gasabo hill is close to Kigali (23 kilometers apart). I therefore include the distance to Kigali as a control.

The instruments enters in the following first stage:

$$Duration_{id} = \boldsymbol{s'_{id}\gamma_1} + \boldsymbol{z'_{id}\gamma_2} + \boldsymbol{q'_{id}\gamma_3} + \nu_{id} \tag{2}$$

Where $Duration_{id}$ is the duration of incorporation of sector i in district d and $\boldsymbol{s_{id}}$ is a vector containing the instruments, the cattle suitability index and the distance to Gasabo and ν_{id} is an error term. The second stage equation is:

$$Violence_{id} = \beta_1 Duration_{id} + \boldsymbol{z'_{id}\beta_2} + \boldsymbol{q'_{id}\beta_3} + \varepsilon_{id} \tag{3}$$

Figure 1 gives a map of Rwanda with the values for the cattle suitability plotted at the sector level as well as a map plotting the expansion of the kingdom. Note that the cattle suitability index also predicts the year of incorporation, and hence the total duration of occupation, outside of the central part of Rwanda. This shows that the cattle suitability index does not just capture the effect of being in the central part of Rwanda versus being in the peripheral part. Results are reported below, in section 3. The exclusion restriction is discussed in section 4.

3 State Capacity and the Rwandan Genocide: OLS and GMM estimates

3.1 Descriptive statistics

Table 1 gives the summary statistics for the main variables of interest, all measured at the level of the administrative sector, the main unit of observation. The web appendix provides the summary statistics for all variables as well as a map of the administrative sectors. It also provides a discussion of the sectors that were dropped in constructing the dataset. Finally, the names of administrative units changed in 2002. The web appendix provides a annotated list of the relevant administrative divisions and name changes.

[insert table 1 about here]

3.2 Ordinary Least Squares results

Column (1) of table 2 shows a strong correlation between duration of incorporation in the precolonial kingdom and violence. Higher precolonial state capacity positively predicts the intensity of the violence in the genocide . The second column includes the percentage of Tutsis living in commune c as a control, controlling for the fact that the genocide effort was directed at those places where more Tutsi lived[24]. The third column adds more controls. Since the genocide was state organized, I include the distance from the capital, Kigali. Indeed, the genocide spread from Kigali following the crash of Habyarimana's airplane. I also add a vector of distance controls, capturing alternative relevant geographical features such as the distance to the country border[25], as well as the the mean elevation and terrain slope of sector i. Since this last column also adds fixed effects at the level of the modern district[26] I find a strong and significant within-district effect of historical state capacity on violence intensity, holding the number of Tutsi that could potentially be killed constant.

[insert table 2 about here]

Although all vectors in equation 1 are indexed by sector i and district d the data are not always necessarily measured at the level of the sector. Distance to Kigali, for instance, is measured at the sector level, but percentage Tutsi at the, higher, *commune* level. To correct for any biases that may arise from these differing levels of measurement, errors in double braces give two way clustered standard errors at the (pre)colonial district level as well as at the commune level (Cameron et al., 2011). This corrects for cross sectional dependence at the level of the primary sampling unit of the duration of incorporation, the precolonial district, as well as at the level at which some controls vary, the commune. An alternative strategy is to use Conley (1999) standard errors that allow for arbitrary spatial correlation. One might, for instance, be worried that shocks to one sector spill-over to adjacent sectors. Using Conley errors corrects for this. I also include standard errors clustered at the (pre)colonial district level. Since these 'simple'

[24] Although the percentage Tutsi can be viewed as an outcome of state capacity through, for instance, forced resettlement controlling for it precludes the possibility of a mechanical correlation through the higher availability of Tutsi targets in the genocide. Normalizing violence by the number of Tutsi instead of total population gives a positive, marginally insignificant (p-value: 0.102), result with a larger coefficient (results available upon request).

[25] Given that the RPF entered Rwanda from Uganda in the north, this variable captures distance from the Ugandan border for those sectors whose closest border is the border with Uganda.

[26] Adding fixed effects at the commune level (there are 145 communes) leaves too little variation within each commune in the duration of incorporation (There are 49 precolonial districts). Modern, post 2002, districts are the lowest level available above the commune. There are 31 modern districts.

one-way clustered standard errors are similar in magnitude to the two-way clustered errors, and the Conley spatial errors are lower, I will use the one-way clustered standard errors from now on.

One could at this point think of several important factors beside state capacity that influenced the intensity the genocide, such as population density (André and Platteau, 1998), the influence of hate radio on the genocide (Yanagizawa-Drott, 2010) or twisted race relations fostered by the Belgian colonizers (Mamdani, 2002). The next sections of this paper deal with these and other factors, starting with an instrumental variable strategy to mitigate concerns about the endogeneity of the duration of incorporation.

3.3 GMM results

GMM results are in table 2 as well. In terms of the system of equations in (2) and (3), the exclusion restriction holds if each instrument in $\boldsymbol{s_{id}}$ does not correlate with the second stage error, ε_{id}. The next section deals with possible reasons why this restriction might be violated. For the estimation of the effect of state capacity on the violence in the 1994 genocide I use a GMM procedure. The linear just-identified GMM estimator is, in this context, identical to an IV specification but makes Conley (1999) standard errors easily implementable. Columns (4-6) present the GMM results for the relation between duration of incorporation and violence, with the relevant elements of $\boldsymbol{s_{id}}$ given above the regression columns. Since the duration of incorporation proxies for state capacity, I expect a positive sign on duration of incorporation.

Column (4) of table 2 shows a positive significant effect of the duration of incorporation on violence, indicating a positive effect of state capacity on intensity of the genocide[27]. Columns (5) and (6) add the same controls as in columns (2) and (3), the percentage Tutsi and the distance to Kigali. The effect survives and the coefficient is stable. Note that the coefficient on duration of incorporation is approximately twice as large in the GMM specifications as it is in the OLS specifications, indicating that measurement error in the duration of incorporation variable creates attenuation bias[28]. Column (7) of table 2 presents an estimate that used two instruments for the duration of incorporation, the cattle suitability index and the distance to Gasabo hill. Column (9) instruments with the cattle suitability index controlling linearly for its components. Columns (7)-(9) of table A2-2 in the web appendix repeat column (1) to (3) of table

[27] Note that the F-stat of the first stage is generally well above 10 mitigating issues concerning weak instruments (Staiger and Stock, 1997).

[28] Another interpretation of this increase in the coefficients is that I identify the Local Average Treatment Effect (LATE) (Imbens and Angrist, 1994) only for those sectors that have something to do with cattle and could therefore be incorporated because of their suitability for cattle. Since I would not expect an effect of the cattle suitability index for those districts that have nothing to do with cattle, the points estimates for the GMM specifications are higher.

2 with using just the distance to Gasabo hill as the instrument.

Instrumenting for duration of incorporation with the cattle suitability index, the distance to Gasabo hill or both, corroborates my OLS findings. I reach the same conclusion as before: there is a significant positive relationship between state capacity and violence in the Rwandan genocide. Note that the coefficients on the duration of incorporation are virtually identical across instruments and specifications. Also note that the p-value from a Hansen J-test is 0.26, indicating the validity of both instruments.

3.4 Spatial correlation and the timing of the genocide

Figure 1 suggests that there is spatial correlation in both the violence data as well as the state capacity data. Clustering standard errors corrects for biases arising from spatial correlation at the level of the cluster. Conley (1999) standard errors also correct for between cluster correlation of standard errors. Figure 4 visualizes the spatial dimension of the genocide in a different way. The genodynamics project[29] has aggregated several news sources reporting on killings in the genocide. For each source, they record the date of the violence reported as well as the prefecture where the violence took place. This allows me to track the expansion of the genocide from Kigali to the rest of the country. Unfortunately, the data are only available at the prefecture level, which is the highest level of administration in Rwanda. Each datapoint in figure 4 corresponds to one prefecture and the reported t-stats are the t-stat of the coefficient in a regression of the distance to Kigali on the relevant date[30]. The top row contains two figures; the lefmost figure relates the date of the first mention of genocidal violence to the distance from Kigali and the right figure relates the date at which 50 percent of the total fatalities reported had been reached to the distance from Kigali. The figures show a weak relation, if any, between the distance from Kigali and the spread of the genocide. This shows that a spatial pattern fanning out from Kigali that jointly determines both violence intensity and the expansion of the Nyiginya is not part of the data generating process.

[insert figure 4 about here]

The bottom row shows partial residual plots of the duration of incorporation and the same dates, having partialled out the distance to Kigali. The figures shows that the duration of incorporation is positively related the onset of the genocide, and positively to the speed of the violence, albeit weaker. Subject to the

[29] Data available at www.genodynamics.com

[30] In the bottom panels the t-stat is the t-stat on the coefficient for the duration of incorporation controlling for the distance to Kigali.

caveat of the high level of aggregation of the data, these figures provide evidence that state capacity was more important for the start of the genocide than the proximity to Kigali.

3.5 The lethality of state capacity

What is the quantitative impact of state capacity in the Rwandan genocide? Moving from the 25 to the 75th percentile of the duration of incorporation lengthens the presence of the state with 146 years. Using the point estimate from the most demanding GMM specification in column (6) of table 2 this implies that going from the 25th to the 75th percentile of the duration of incorporation increases violence by 8 percent. Column (8) of table 2 looks just at people convicted in category 2, the category for murder. The dependent variable here is the number of people convicted for murder normalized by the population from the 1991 census. Using this estimate I find that an extra 150 years of state history gives rise to a 5 percent increase in violence.

4 Threats to identification and robustness

This section deals with different aspects of the robustness of the results in section 3. First, section 4.1 discusses the exclusion restriction underlying the GMM estimates presented in table 2. Second, section 4.2 covers potential issues with the measurement of the data. Third, section 4.3 also reviews a large number of alternative explanations and their influence on the relationship between state capacity and violence as well as potential issues with the dataset. Finally, a falsification exercise shows that duration of incorporation does not predict violence in Rwanda if this violence is not state organized. This section shows that the main results are robust and that using cattle suitability as an instrument satisfies the exclusion restriction.

4.1 The exclusion restriction

The main threat to identification is that the cattle suitability index has a direct effect on violence in the genocide. In terms of equation (1), the exclusion restriction is violated if s_{id} is part of the population analogue of (1) with a coefficient that is non-zero[31]. This would be the case if, for instance, areas that were most suitable for cattle are richer in soil and therefore perpetrators of the genocide expected richer people to live there, making these areas attractive targets in the genocide. By the time of the genocide, however, cattle had lost its prominent position in Rwandan society. There are several reasons for the (relative) loss of

[31] That is, it shows up in the 'true' relationship between state capacity and the intensity of the genocide. Omitting it from (1) would the cause the cattle suitability index to correlated with the error term, violating the exclusion restriction.

importance of cattle and cattle herding by the time of the genocide. First, post-independence agricultural policy was aimed at relieving population pressure by extending the land under cultivation[32] (that is, along the extensive margin), at the expense of cattle herding (Verwimp, 2013, p. 39). This had as a consequence that the land frontier was reached in the by 1990 (Ibid., p. 122). Another consequence was that in 1986 only 16 percent of land in Rwanda was used for pasture versus 66 percent for agriculture (Ibid. p. 61). Second, the agricultural sector as a whole had shrunk. In terms of income, agriculture accounted for only 48 percent of Rwandan GDP in 1986 (Mamdani, 2002, p. 145). Third, the *ubuhake* contract was abolished in 1954. Although the labour duties continued in an adapted form, they no longer revolved around cattle. Fourth, within the agricultural sector, people were substituting away from cattle. The 1959 revolution removed the right of chiefs to hold private pasture land, freeing up large plots of land used for cattle to be used for crops (Mamdani, 2002, p. 146). Also, a typical household in 1990 derived only 5,5 percent of its income/consumption from livestock-related products versus nearly sixty percent from subsistence consumption of crops (Verwimp, 2013, p.63). Finally, the introduction of a money economy, for instance through cash crops like coffee, stripped cattle of its role as a store of wealth.

Yet, there may be factors that were influenced by cattle in the precolonial period and have persisted. This would threaten the exclusion restriction as well. Cattle suitability could, for instance, correlate with Tutsi presence or with wealth in general. If this were true, this would be a direct channel between my instrument and violence in the genocide. Columns (1)-(3) of table A2-2 in the web appendix show that the effect of state capacity on violence is not driven by, respectively, a higher presence of Tutsi, colonial wealth (measure by cattle density) or modern pre-genocide wealth.

It is also possible that general agricultural suitability is the relevant direct channel between cattle suitability and the genocide. Columns (4) and (5) show that this is not the case. Column (4) controls for the suitability of two main staple crops (Bananas and Sorghum) and two cash crops (Coffee and Tea). Column (5) controls for the number of coffee pulping centers in 1960. Throughout all these specifications, the result stands and coefficients are stable.

[32]In a celebratory government publication in 1987, looking back on the 1959 coup, it was argued that it was a peasant revolution in which "the predominance of the cow was replaced with the predominance of the hoe" (Verwimp, 2013, p. 50).

4.2 Measurement and construction of the dataset

A first concern is the measurement of the dependent variable, the normalized sum of the number of convicts in the three categories. Since the Gacaca courts administer local justice, higher local state capacity could mechanically result in a higher number of convicts through increased efficiency of the Gacaca courts. If this were true, the main result of this paper would just reflect the persistence of state capacity. This is, however, not the case. The Gacaca data is split up into three categories, category 1 is comprised of ringleaders and political leaders involved in organizing the genocide and categories 2 and 3 are comprised of individuals harming/killing other individuals or property. It is reasonable to assume that identifying the crimes of individual people having killed or stolen is harder than to identify leaders. For instance, leaders will be more widely known and therefore easier to trace. Therefore, I expect a less significant effect of state capacity on the number of convicts in category 3 than on the number of convicts in category 1. Table A2-1 in the web appendix replicates the baseline OLS specification of column 3 in table (1) for each category separately. For category 1, as well as 2 and 3, it also replicates column 3 without fixed effect since the number of ringleaders and organizers varies at a higher level than the number of individual convicts. The effect of state capacity on the number of convictions is equally significant throughout all categories (without fixed effects), illustrating that it is equally likely to be convicted in all categories, irrespective of how hard it is to convict a person in a particular category.

The same regressions show that the main result are not sensitive to the way my measure of violence in the genocide is constructed. Using any category or a principal component of the violence categories does not change the result.

A related potential problem is that the coding of the year of incorporation from Vansina (2004). I coded up the year of incorporation for district that are mentioned in his narrative directly from the text (see web appendix 1 for the precise coding method). Vansina may have selective used districts in his text, creating a bias in the dependent variable. If this bias correlates with an unobservable, my results become hard to interpret. Table A2-4 in the web appendix gives results for a different measure of duration of incorporation, an 'incorporated by year t' measure. Vansina (2004) has four maps of cross-sections of the expansion of the kingdom at , displaying all districts used in my datasets. The 'incorporated by year t' measure of the expansion of the kingdom codes a certain district as incorporated only if it appears as part of the kingdom on a map that gives a cross section of the kingdom at year t and not on an earlier cross-section. The

results remain the same, but the standard errors are slightly larger reflecting the extra measurement error introduced by the lumping of years of incorporation into the cross-sections.

A final potential problem is underreporting of the number of Tutsi in the 1991 census. Studying Gikongoro province, Verpoorten (2005) suggests that multiplying the reported number of Tutsi by 1.4 should eliminate any underreporting. It is very hard, if not impossible, to assess any sytematic variation in underreporting in 1991 in Rwanda. That said, higher local state capacity would arguably lead to a more precise identification of ethnicity, leading to less underreporting. Therefore, any bias resulting from underreporting will bias the estimates downward.

4.3 Robustness

This section tests several alternative explanations from the literature against the duration of incorporation. Many of these explanations can themselves be seen as outcomes of state capacity. This paragraph aims to show that the duration of incorporation has explanatory power over and above alternative explanations. Paragraph 5 tracks the effect of state capacity over time, treating some of the alternative explanations as intervening variables.

4.3.1 Alternative Explanations

A few main hypotheses regarding local variation in violence intensity exist, surveyed in Mamdani (2002), Des Forges (1999) and Hintjens (1999). I review these factors and their effect on the robustness of the results in section 3 by adding them to the baseline specification from table 1[33]. Columns (1) and (3) of table 4 include the number of schools in 1960 and the percentage of people that were literate from the 1991 census. Mamdani (2002, p. 7) and Des Forges (1999, p. 10) show that schools were often used as places to drive Tutsi together and then kill all of them at once. Furthermore, even throughout the Hutu-dominated period from 1963-1994 Tutsi received more education than Hutus (Mamdani, 2002, p. 89). This would suggest greater violence intensity in districts with more schools.

Literacy is expected to correlate with the intensity of the genocide through multiple channels. Literate people tend to be better educated and tend to earn more. This made them a target in the genocide. Furthermore, (Mamdani, 2002, p. 199) argues that more literate youth were less likely to obey the orders

[33]Table A2-6 in the web appendix enters these factors by themselves, removing the duration of incorporation from the regressions.

given or be a member of a *interahamwe* militia. Both the number of schools and the literacy rate enter insignificantly and thus have no effect over and above state capacity and the distance to Kigali. The same results hold unconditionally, with duration of incorporation removed from the regressions.

The Belgians created the coffee industry in Rwanda and for a long time this was a major export sector, accounting for 75% of Rwanda's exports (Des Forges, 1999, p. 46). Just before the genocide the sector all but disappeared. Production fell sharply in response to a large price drop on the international market and interest rate measures imposed by the World Bank worsened Rwanda's terms of trade. The industry collapsed impoverishing many people in the coffee growing area. I expect these areas to be more heavily involved in the genocide since they had a surplus of young people (Mamdani, 2002, p. 148 and p. 204). Furthermore, Habyarimana's power was weakened considerably by the collapse of the coffee industry because he used its proceeds to sustain his patronage network. When these proceeds ran out, he had to resort to repression (Verwimp, 2013, p. 80). I include the number of coffee pulping centers in 1960 as a measure of the distribution of this industry before it collapsed. It enters positively and is significant at the five percent level. Having more coffee pulping centers predicts violence intensity but the effect of state capacity remains strong and significant.

The next two controls, the percentage of people self-reporting in the 1991 census to be employed in the military and the percentage of people self-reporting to be from Burundi, are motivated by qualitative evidence that suggests that these groups were disproportionally representated among the perpetrators of the genocide (Mamdani, 2002, p.205). Both controls enter insignificantly and the coefficient is stable.

Following Yanagizawa-Drott (2010), column (6) adds the percentage of people that own a radio. He shows that the 'hate radio'[34] was instrumental in the genocide and in fact explains a large part of the violence. As a control, it is insignificant both in the specification including year of incorporation as without. The coefficient remains unchanged.

The last control is population density. The literature argues that the high population density in Rwanda created Malthusian pressures and these were partly responsible for the outbreak of the genocide (André and Platteau, 1998). In columns (7) and (8) I look at the effect of population density and population density over and above the effect of the percentage of Tutsi. I find a negative significant effect, both conditional

[34]The RTLM, 'radio television libres des milles collines'.

on including year of incorporation and unconditionally. Places that had higher population density in 1991, when the census was held, experienced lower violence intensity[35].

The result that historical state capacity predicts the intensity of the genocide is robust to including these alternative explanations, the coefficient hardly falls moving from columns (1-8) to (9). From these estimates, it is possible to get a quantitative sense of what this means for the extent to which my results depend on unobservables (Altonji et al., 2005). I use the ratio $\frac{\hat{\beta}_{control}}{\hat{\beta}_{baseline}-\hat{\beta}_{control}}$ where $\hat{\beta}_{control}$ is the coefficient on the variable of interest in a regression that includes controls and $\hat{\beta}_{baseline}$ is the coefficient on the same variable of interest in a regression that uses little or no controls (Bellows and Miguel, 2009). This index then captures the bias unobservables would need to introduce to make the result go away, based on the extent to which observable controls make the result weaker. If the coefficient drops substantially when including more controls this ratio will be low and we would expect the result to be sensitive to unobservables. If the coefficient is stable this indicates that the result is plausibly less dependent on unobservables. Using coefficients on the duration of incorporation in columns (1) and (9), for instance, I obtain $\frac{0.0270}{0.0298-0.0270} = 15$ indicating that the bias that would arise from unobservables should be fifteen times as high as the bias that results from omitting the observables added in (9) over and above the ones already present in (1)[36].

4.3.2 Other controls

Besides the above controls, I control for several historical variables, mainly from the colonial period[37]. All scholars of the genocide (for instance Des Forges (1999), Prunier (1995) and Mamdani (2002)) point to the importance of colonialism for contemporary development. From maps in colonial records[38] I reconstructed the number of head of cattle per sector in 1960 as a measure of colonial wealth, the number of hospitals (including dispensaries) in 1935, as a measure of colonial public health and public good provisions, and the number of missionary stations (any denomination) in 1935, controlling for the influence of missionary

[35]This finding is robust to several alternative specifications. I used the absolute value of violence as a dependent variable instead of the normalized violence measure used throughout. I dropped the top 10% of population density observations, I used total population separately and jointly with population density. The result stands throughout all specifications.

[36]Similarly, this statistic computed for column (9) of table 5 and the baseline OLS specifications from column (1) in table 1 (with added fixed effects) is $\frac{0.0270}{0.032-0.0270} = 5.4$. This implies that the bias resulting from unobservables must be 5.4 times as high as the bias that results from omitting the most important determinants of the genocide from the literature to make the result go away.

[37]Table A2-4 includes these variables in the OLS specifications and table A2-5 in the same appendix includes the main confounding variables for the GMM specification.

[38]see appendix 1 for the sources for all variables mentioned in this section

activity on development (Nunn, 2010) . I also include the number of missionary stations in 1924 (Ibid.). I control throughout for distance to Kigali and the percentage Tutsi, the controls from table 1. Cattle as well as hospitals enter significantly but the effect of state capacity remains significant and the coefficient is stable.

I also control for a set of geographical variables, TseTse suitability, elevation, slope, pasture suitability and distance to the border, the nearest river, the nearest town and the nearest road. The main result is robust to including all these controls[39] and the coefficient is stable.

[insert table 5 about here]

4.3.3 Focusing on persistent state capacity

Before presenting the relevant correlations showing the persistence of state capacity, I perform a falsification exercise. In theory, modern state capacity could just be one of the channels connecting precolonial state capacity to the intensity of the genocide. The motivation for positing modern state capacity stems from the fact that the genocide was highly state organized. Looking at another period of conflict in Rwanda, I would therefore expect to find a weak or insignificant effect of precolonial state capacity, provided this conflict was not as highly state organized as the genocide. To carry out this falsification exercise, I have collected data on violence before and after the genocide. Table 3 shows IV estimates similar to the ones in table 2. The dependent variable in columns (1-3) is a dummy which gets a one if sector i had 'place of conflict' from the 1959 coup[40]. Since the probit marginal effects are very similar to the linear probability coefficients in an OLS specification of columns (1-3), I have used a regular two stage least squares approach. In columns (4-6) the depedent variable is the count of the number of incidents reported in the Armed Conflict Location and Events dataset over the period 1997-2012, capturing post genocide violence.

Moving across from column (1) to (6) the effects of historical state capacity on violence before and after the genocide flip sign, are not robust to the inclusion of the percentage Tutsi, and are largely insignificant. This shows that state capacity only predicts violence when this violence is state organized, providing a justification for focusing on modern state capacity as a channel and providing further justification for using historical state capacity as a proxy for modern state capacity.

[39] I do not include the historical controls in the main specifications of table 2 since they can be viewed as outcomes of historical state capacity. That is, they are 'bad controls' (Angrist and Pischke, 2008). I include the geographical variables used in the main specifications here separately to disentangle their joint effect.

[40] 'lieu d'affrontement', see web appendix 1.

5 State capacity persistence and its determinants

In this section, I show that the correlation between precolonial state capacity and the intensity of the genocide works through persistent state capacity. I also reviews some factors that influence the degree of persistence.

5.1 The persistence of state capacity

In this section I provide evidence that state capacity in Rwanda persisted from the Nyiginya kingdom until 1994, corroborating the results from the falsification exercise in the previous section. I present evidence that local state capacity persists through the colonial period, the postcolonial Rwandan state up to 2000. I review several indicators of local public good provision (Gennaioli and Rainer, 2007) and income, such as cattle ownership, road density, vaccination rates, several variables relating to public education and satellite density at night..

[insert table 6 about here]

5.1.1 Persistence through the colonial period: 1898-1963

Columns (1-3) of table 5 correlate the duration of incorporation with a measure of income in the colonial period, the number of 500 head of cattle in 1960 as well as with two measures of public good provision, the number of elementary schools and the number of hospitals. The data come from historical colonial maps I digitized (for data sources, see appendix 1). The duration of incorporation positively predicts the number of cattle and the number of schools. The effect on the number of hospitals has the right sign but is insignificant. State capacity therefore predicts income and public good provision through the colonial period.

5.1.2 Persistence through the post-independence period: 1964-1994

Columns (4-6) report correlations of the duration of incorporation with three measures of public good provision in the period leading up to the genocide. In column (4), the dependent variable is the density of the road network in 1988. Due to the quality of the roadmap I digitalized I measure the road density at the commune level, one level above the sector level at which I usually measure outcome variables. Column (5) has the number of secondary schools in 1980, also digitized from a map (for data sources, see appendix

1). The final dependent variable, in column (6), is the percentage of people that are literate in commune c and is taken from the 1001 census.

Figure 2 gives immunization rates from the 1992 DHS survey held in Rwanda. Unfortunately, the geographical variables indicating the sector or commune are unavailable. Hence, I rely on the prefecture (highest subnational administrative level). This significantly reduces the number of observations and the results should therefore be interpreted with caution. I use data on the BCG vaccine, the vaccine against tuberculosis, since the question asking whether the respondent has had this vaccine has highest response rate of all questions on immunization, making it the most representative sample. Figure 2 shows that historical state capacity positively predicts the vaccination rate in 1992. As with the colonial outcome variables, the duration of incorporation consistently predicts public good provison in the period leading up to the genocide.

[insert figure 2 about here]

5.1.3 Persistence 1993-2000: Satellite light density at night

Several papers have used satellite light density at night as a proxy for income (Bleakley and Lin, 2012; Henderson et al., 2012; Michalopoulos and Papaioannou, 2013). Michalopoulos and Papaioannou (2013) show, for instance, that precolonial state capacity in Africa, measure at the ethnicity level, predicts modern income, proxying for income with satellite light density. I report correlations between the duration of incorporation and the mean satellite light intensity of sector i in Panel II of Table 5. Columns (1)-(6) use the average light density over several different years as the dependent variable. Given the pervasive correlation between anthropological measures of political centralization and light density, the duration of incorporation measure should correlate with light density. Table 5 reports standardized coefficients for the light density correlations. Note that the coefficient on duration of incorporation is always positive, significant and stable, except for genocide year 1994, when it is much lower (cf. also the maps in figure 3).

[insert figure 3 about here]

5.2 Explanations for state capacity persistence

Table 4 shows that precolonial state capacity significantly predicts the presence of public education facilities as well as literacy and educational attainment. The evidence on road density, immunization and

public education points to the correlation of state capacity over time validating the use of precolonial state capacity. This is, of course, not the first attempt to identify the determinants of institutional persistence. The literature identifies several channels linking precolonial institutions persist and shape present day outcomes. Gennaioli and Rainer (2007) and Herbst (2000) advance a 'local accountability' hypothesis suggesting that state capacity is more persistent due to local power structures. In places where polities were more centralized, chiefs were more accountable and this persisted through colonialism shaping development outcomes today. Mamdani (1996) holds that indirect rule made chiefs unaccountable but in areas with centralized polities, pre-existing accountability constraints impeded this. These constrains persisted and explain, in turn, the persistence of precolonial institutions we observe. Indeed, precolonial power structures are found to be important today (Goldstein and Udry, 2008). I provide some tentative evidence for this hypothesis from the World Values Survey in web appendix 1. Another channel is the persistence of public goods. Larger centralized polities such as the Ashanti empire, Dahomey and Buganda, for instance, created extensive road systems. Osafo-Kwaako and Robinson (2013) show that precolonial political centralization is correlated with the provision of public goods such as road construction and the use of money. A third factor is the interaction between more or less centralized polities and the colonizers. Several authors argue that more centralized precolonial polities were more succesful in their interaction with Europeans and obtained, thereby, technology such as guns more easily, solidifying their rule (Claessen and Skalník, 1978; Schapera, 1956).

The above explanations for state capacity persistence, or institutional persistence more generally, implicitly fall into two categories: those that presuppose that institutions persist through the human capital of those running them or those that presuppose that the persistence is embodied in the rules/laws/conventions creating the instutions and are independent of those running them. From a 'human capital perspective' the persistence in Rwandan state capacity is striking since human capital was generally low and local chiefs were frequently replaced. Table 6 sheds some light on this distinction. Table 6 presents results from the following regression:

$$RoadDensity_{id} = \beta_1 Duration_{id} + \boldsymbol{\beta_2 z_{id}} + \boldsymbol{\beta_3 z_{id}} * Duration_{id} + \varepsilon_{id} \tag{4}$$

Where $RoadDensity_{id}$, the total length of roads normalized by area measured at the commune level but attributed to each constituent sector i, is a measure of modern public good provision. $Duration_{id}$ is the duration of incorporation. $\boldsymbol{z_{id}}$ is a vector of controls, consisting of two human capital variables, the number

of schools in 1960 and the number of higher education establishments (secondary schools) in 1980. The interaction term captures the idea that there might be differential persistence in state capacity, captured by the correlation between precolonial and modern state capacity for different values of the controls in the $\boldsymbol{z}$ vector.

[insert table 7 about here]

Column (3) of table 7 includes the entire vector $\boldsymbol{z}$. Although the coefficients on the human capital variables and the interaction terms have a different sign, they are statistically indistinguishable from zero. This provides evidence that persistence in state capacity does not work through the human capital employed in exercising state functions and that the frequent changes of leadership and upheavals in twentieth century Rwandan history are no impediment to persitent state capacity nor to using precolonial state capacity as a proxy for modern state capacity.

6 Concluding Remarks

In this paper, I considered the link between state capacity and development, focusing on the Rwandan Genocide. Using a novel data set I have shown the adverse effects of state capacity on development. More specifically, state capacity positively, significantly and robustly predicts the intensity of violence in the Rwandan Genocide. This finding contrasts several studies finding a positive association between precolonial state capacity and modern day development outcomes such as the work of Besley and Persson (2011) and Fearon and Laitin (2003). I measure precolonial state capacity by the duration of incorporation of a district into the Nyiginya kingdom. The unique social institutions of this kingdom enabled patrons to tie their clients to the land making annexation of new parts to the kingdom a well defined, measurable, quantity (Herbst, 2000). I hypothesize that precolonial state capacity, measured by duration of incorporation, correlates with modern state capacity and this state capacity explains the genocide. I find strong empirical support for this chain of reasoning. However, duration of incorporation is endogenous. I use the pivotal role of cattle in the Nyiginya kingdom as a source of exogenous variation in the year of incorporation. Places that were more favourable to keeping cattle were conquered earlier. Using my cattle suitability index as an instrument I confirm the relationship between precolonial state capacity and the intensity of the violence in the genocide. I also show that state capacity persists through time connecting precolonial state capacity to modern state capacity to the intensity of the genocide. A simple falsfication justifies the

focus on persistent state capacity over other potential channels.

My paper sheds light on the complex relationship between state capacity, violence and development (Blattman and Miguel, 2010; Besley and Persson, 2010). I find that state capacity can have adverse effects when used by one group in society against another. Furthermore, I find that local state capacity persists trough time.

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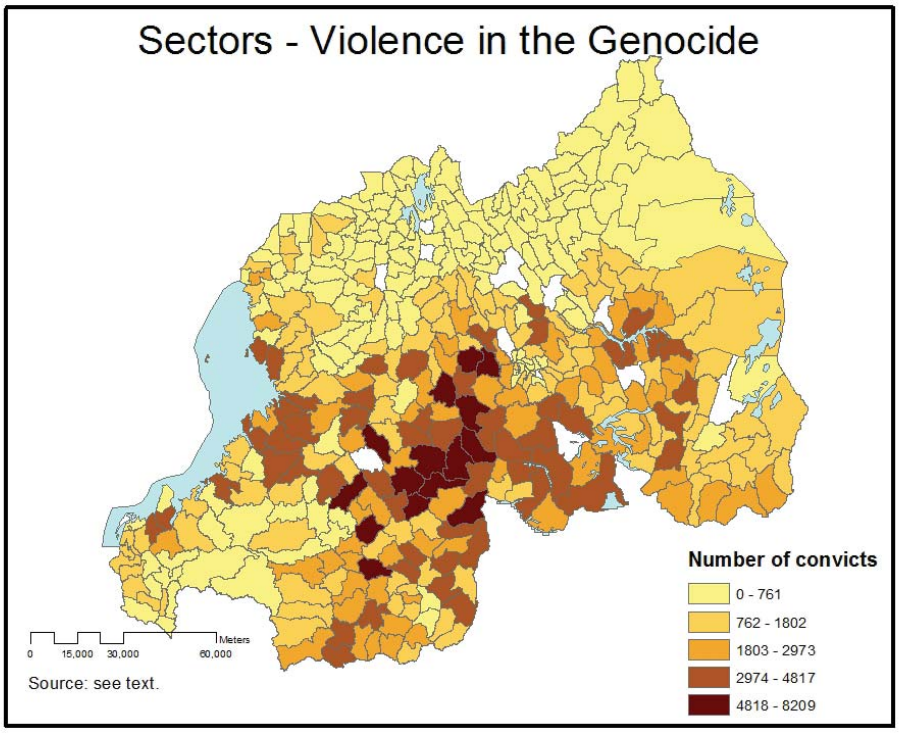
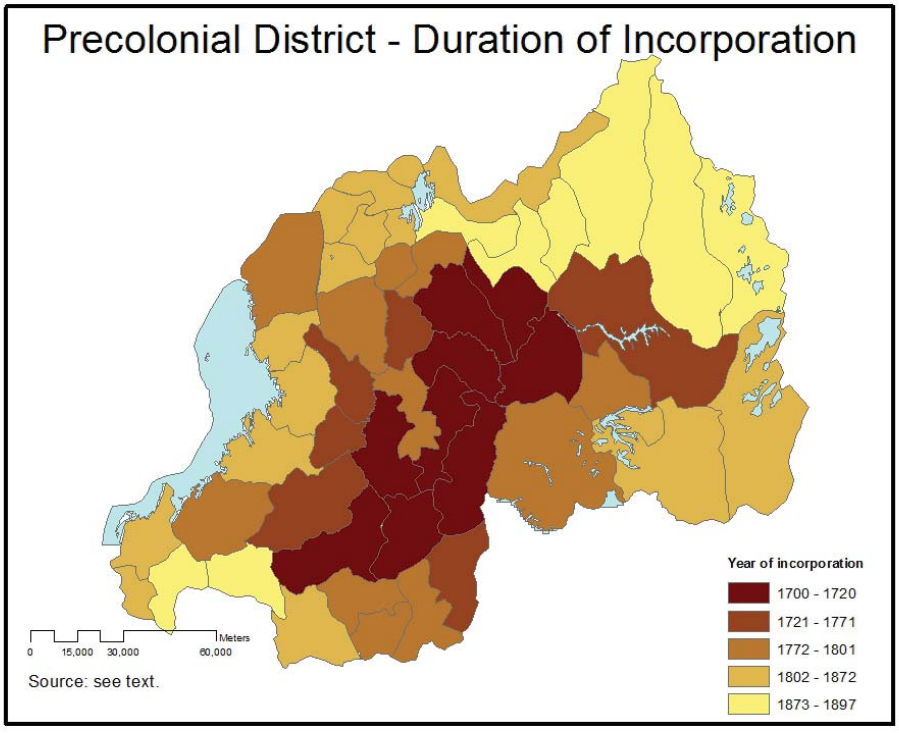
Figure 1: The year of incorporation, the cattle suitability index and the intensity of violence in the genocide





The year of incorporation, the cattle suitability index and the intensity of violence in the genocide continued

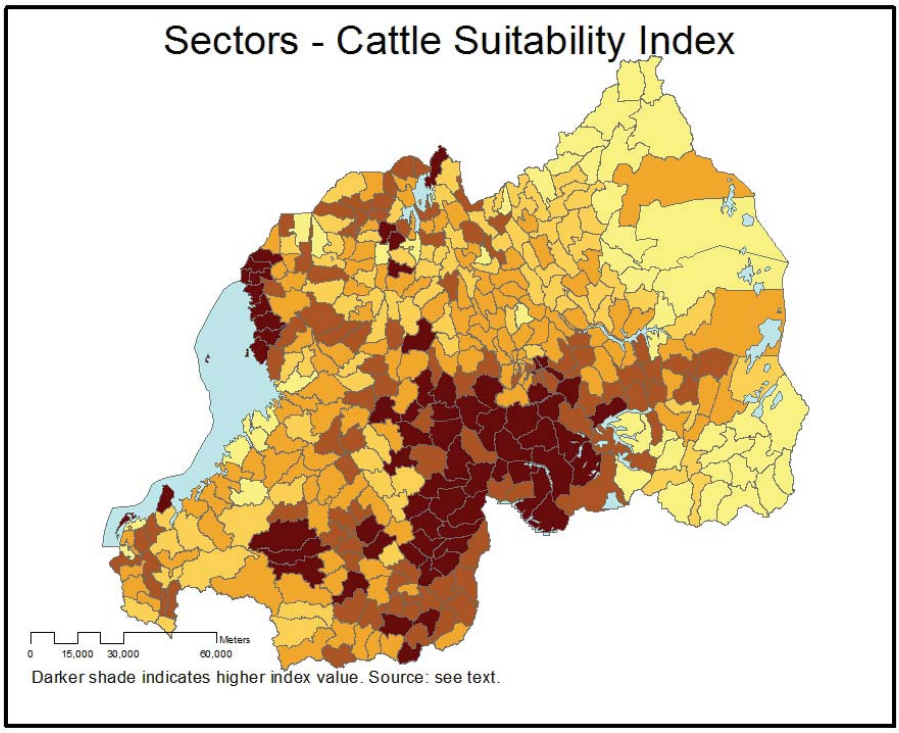


Figure 2: Vaccination rates

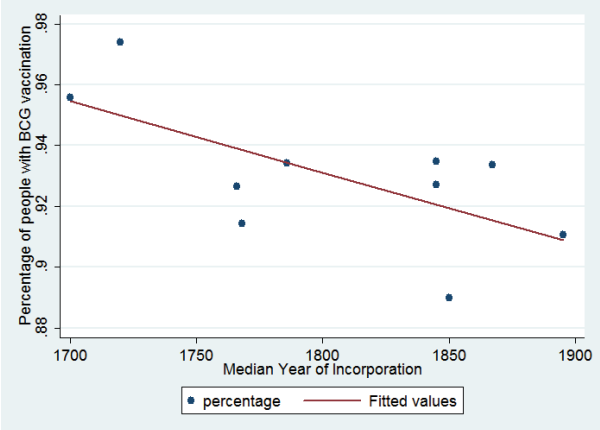
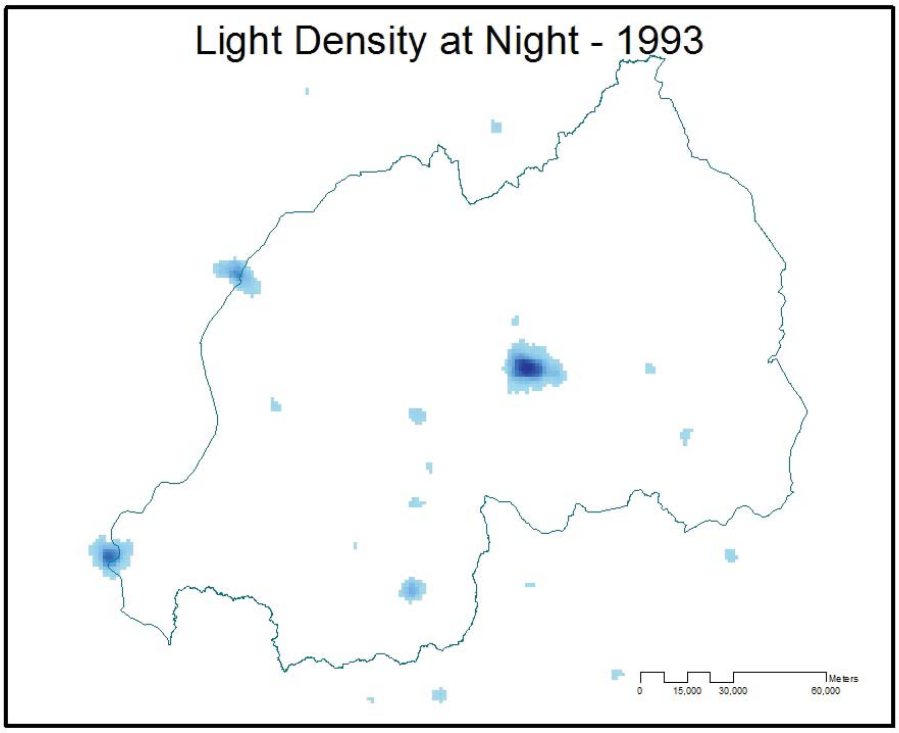


Figure 3: Mean Satellite light density for 1993 and 1994



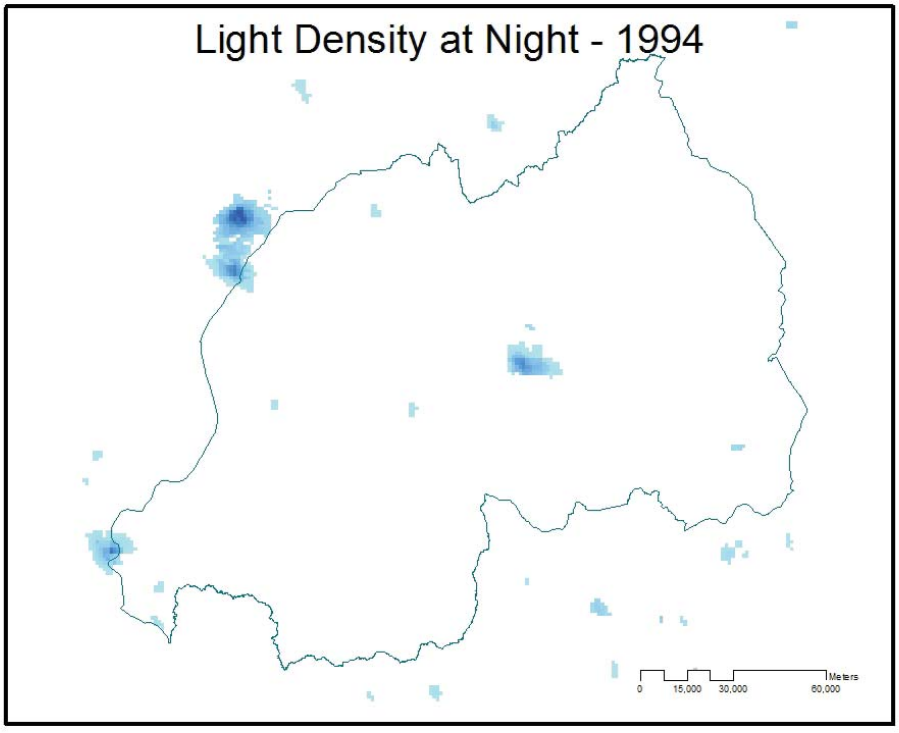


Figure 4: The timing of the genocide

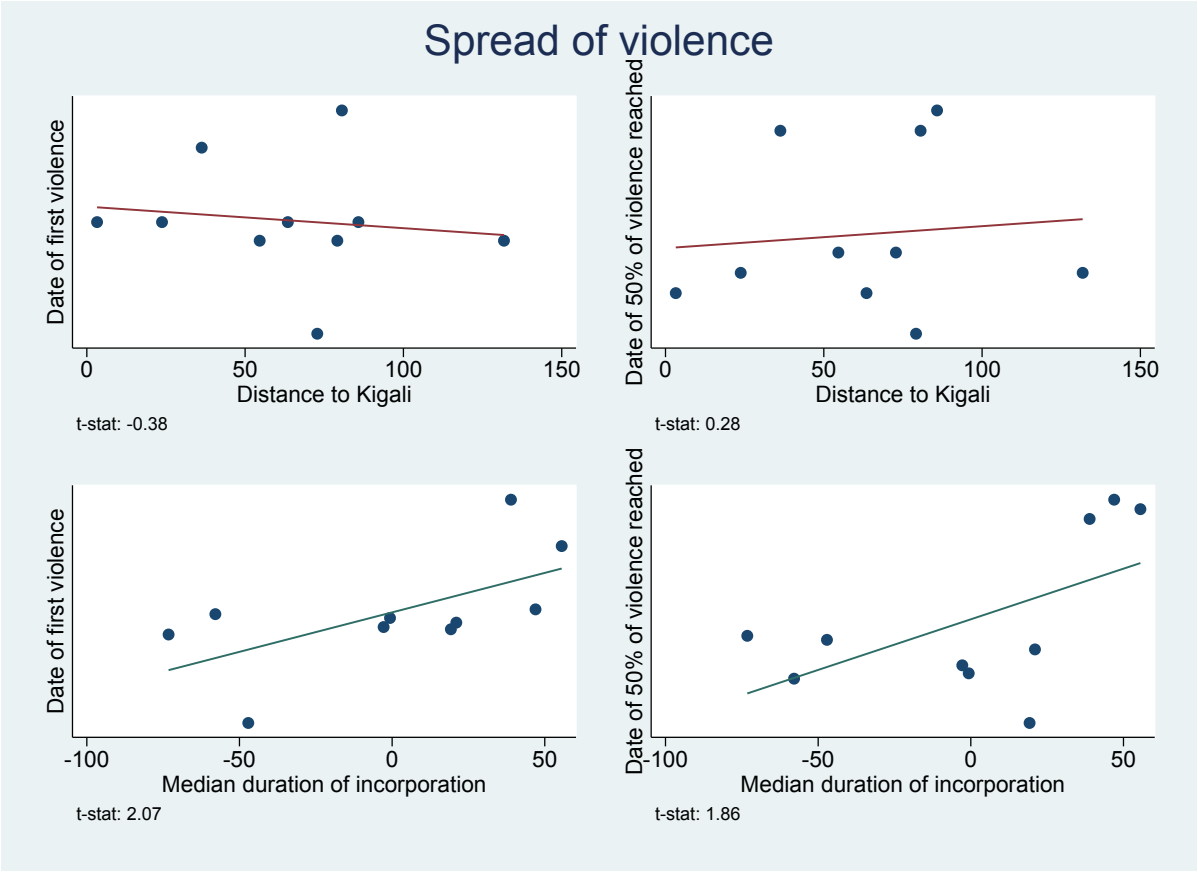


Table 1: Main Summary Statistics

	N	Mean	Standard Deviation	Min	Max
Abs(Violence)	373	1590.303	1540.06	0	8209
Violence	373	0.086	0.796	0	0.444
Year of Incorporation	373	1794	65	1700	1897
Distance to Kigali	373	58.722	31.540	0.34	146.690
Percentage Tutsi	373	0.075	0.073	0	0.446
TseTse Suitability	373	0.9319	0.1812	0.002	1
Slope	373	3.749	2.38	0	15.39
Pasture Suitability	373	0.7587	0.1294	0.3074	1

Data sources are given in appendix 1. Abs(Violence) is the sum of the three violence categories recorded in the Gacaca courts. Violence is this value normalized by population from the 1991 census. TseTse is recoded to lie between 0 and 1 and it is inverted such that a higher score means less TseTse. Pasture Suitability is rescaled to lie between 0 and 1.

Table 2: Main results - OLS and GMM

	OLS			GMM			GMM		
				Instrument: Cattle suitability			*Instrument: Cattle & Gasabo*	*Instrument: Cattle Suitability*	
	(1) Violence	(2) Violence	(3) Violence	(4) Violence	(5) Violence	(6) Violence	(7) Violence	(8) Murder	(9) Violence
Duration of Incorporation	0.0472***	0.0372***	0.0233**	0.0963***	0.0742***	0.0546**	0.0800***	0.0293**	0.104**
	(0.0057)	(0.0054)	(0.0066)	(0.0174)	(0.0195)	(0.0223)	(0.0087)	(0.006)	(0.0215)
	[0.0114]	[0.0098]	[0.0091]	[0.0288]	[0.0287]	[0.0249]	[0.0138]	[0.0131]	[0.0512]
	{0.0116}	{0.0099}	{0.0088}	{0.0293}	{0.0292}	{0.0253}	{0.0134}	{0.013}	{0.05}
Percent Tutsi		33.80***	1.205		25.53**	21.60**	14.59*	12.04**	
		(8.192)	(7.599)		(11.80)	(10.47)	(8.352)	(5.376)	
Distance to Kigali			-0.0584			0.0414	0.0577**	0.0173	
			(0.0502)			(0.0296)	(0.0271)	(0.0149)	
Slope									-0.0955
									(6.199)
TseTse prevalence									-7.091
									(6.369)
Pasture Suitability									7.681
									(5.103)
Geographical Controls	N	N	Y	N	N	Y	Y	Y	N
Distance Controls	N	N	Y	N	N	Y	Y	N	N
District Fixed Effects	N	N	Y	N	N	N	N	N	N
Colonial Districts	49	49	49	49	49	49	49	49	49
Communes	144	144	144	144	144	144	144	144	144
Observations	383	383	383	373	373	373	373	373	373
R^2	0.150	0.245	0.493	0.000	0.166	0.299	0.251	0.302	0.000
First Stage F-stat				16.42	9.03	18.33	17.20	13.27	8.63
Hansen J-Stat p-value							0.26		

Violence is the number of prosecutions for Genocide violence normalized by population from the 1991 census. Murder is the number of convictions in category 2 normalized by population in the 1991 census. See appendix 1 for the data sources for this table. Cattle indicates the cattle suitability index and Gasabo indicates the distance to Gasabo. Duration of Incorporation is measured as 1897 minus the year of incorporation of sector i. The GMM specifications are two-step GMM, using the cattle suitability index as the instrument. Fixed Effects indicates fixed effects at the modern district level. Geographical controls include the mean elevation of a sector and the terrain slope under the centroid of this sector. Distance controls consist of distance to the border, distance to the nearest river and distance to the nearest major road, measured from the centroid. Parentheses give Conley (1999) standard errors allowing for arbitrary spatial correlation. I have used weights such that every observation within 4 decimal degrees of the observation in question gets weight one and everything further away weight 0. Square brackets give errors clustered at the (pre)colonial district level. Braces indicate two way clustered standard errors with levels of clustering at the colonial district and commune. Communes gives the number of commune clusters used and colonial districts gives the number of colonial district clusters used in the two way clustering procedure. * indicates significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table 3: Falsification Tests

	IV			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
	Incidents: 1997-2012	Incidents: 1997-2012	Incidents: 1997-2012	Violence 1959	Violence 1959	Violence 1959
Duration of Incorporation	0.0190*	0.0260	0.0311*	-0.0000737	-0.000165	0.000265
	(0.0109)	(0.0161)	(0.0182)	(0.000357)	(0.000618)	(0.000337)
Percent Tutsi		-8.054	-7.698		0.106	0.0212
		(5.953)	(5.785)		(0.156)	(0.101)
Distance to Kigali			0.0111			0.0000492
			(0.0168)			(0.000325)
Geographical Controls	N	N	Y	N	N	Y
Distance Controls	N	N	Y	N	N	Y
Clustered Standard Errors	N	Y	Y	N	Y	Y
Observations	373	373	373	373	373	373
R^2	0.0000	0.0000	0.0000	0.0000	0.0000	0.028

Incidents: 1997-2012 is the number of violence incidents in the period 1997-2012. Violence 1959 is a dummy for whether there was a violent encounter between Hutus and Tutsis in the 1959 coup. In the IV specifications, the cattle suitability index is used the instrument. In a similar specification, OLS and probit results are very similar. For all data sources, see appendix 1. Geograpical controls include the mean elevation and the terrain slope of a sector, measured under the centroid. Distance controls consists of distance to the border, distance to the nearest river and distance to the nearest major road, measured from the centroid. Clustered Standard Errors means that standard errors are clustered at the precolonial district level. Standard errors in parentheses. * indicates significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table 4: Alternative Explanations

	(1) Violence	(2) Violence	(3) Violence	(4) Violence	(5) Violence	(6) Violence	(7) Violence	(8) Violence	(9) Violence
Duration of Incorporation	0.0298***	0.0293***	0.0319***	0.0314***	0.0319***	0.0323***	0.0311***	0.0306***	0.0270***
	(0.00952)	(0.01000)	(0.0101)	(0.00980)	(0.00987)	(0.0101)	(0.00971)	(0.00931)	(0.00947)
Number of Schools 1960	0.158								0.109
	(0.0964)								(0.108)
Number of Coffeepulping Centers		0.471**							0.343
		(0.203)							(0.256)
Percent Literate			-1.793						8.941
			(17.20)						(13.02)
Percent employed in Military				-28.36					-45.98
				(56.06)					(57.99)
Percent Burundi					-79.75				-47.64
					(49.53)				(42.76)
Percent owns Radio						4.490			0.873
						(7.734)			(5.936)
Population Density							-176.1***	-187.6***	-180.7**
							(23.83)	(27.43)	(69.00)
Percent Tutsi								12.54	
								(7.635)	
Observations	383	383	383	383	383	383	383	383	383
R^2	0.464	0.463	0.459	0.459	0.463	0.460	0.472	0.479	0.483

All regressions are OLS. Violence is the number of prosecutions for genocide violence normalized by population from the 1991 census. All specifications include fixed effects at the modern district level. Clustered standard errors are clustered at the precolonial district level. Standard errors in parentheses. * indicates significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table 5: State capacity persistence

Panel I	Colonial Persistence: 1898-1962			Independence Persistence: 1963-1994		
	Number of 500 cattle 1960	Number of Schools 1960	Number of Hospitals 1960	Road Density 1988	Number of Secondary Schools 1980	Percent Literate 1991
	(1)	(2)	(3)	(4)	(5)	(6)
Duration of Incorporation	0.0202***	0.0186**	0.000544	0.0200**	0.00685**	0.0437***
	(0.00610)	(0.00755)	(0.000565)	(0.00908)	(0.00269)	(0.0114)
Clustered Standard Errors	Y	Y	Y	Y	Y	Y
Geographical Controls	Y	Y	Y	Y	Y	Y
Observations	383	383	383	383	383	383
R^2	0.125	0.074	0.009	0.030	0.111	0.324

Panel II	Persistence 1993-2000: Mean Satellite Light Density at night for different years					
	1993	1994	1995	1992/93	1995/96	1992-2000
	(1)	(2)	(3)	(4)	(5)	(6)
Duration of Incorporation	0.0263***	0.00930***	0.0207***	0.0273***	0.0226***	0.0235***
	(0.00637)	(0.00255)	(0.00513)	(0.00650)	(0.00556)	(0.00570)
Robust Standard Errors	Y	Y	Y	Y	Y	Y
Geographical Controls	Y	Y	Y	Y	Y	Y
Observations	383	383	383	383	383	383
R^2	0.056	0.045	0.054	0.059	0.055	0.057

All regressions are OLS. Panel I: Number of 500 cattle is the number of 500 head of cattle in sector i. Number of Schools 1960 is the count of primary schools in 1960 in sector i. Number of hospitals 1960 is the count of hospitals and dispensaries in 1960 in sector i. Number of Schools 1980 is the number of higher education establishments in 1980. Road density is the road density at the Commune level, measured in hundreds of kilometers. Percentage literate is the percentage of people that are literate (reading and writing). Percentage No Education is the percentage of people with no education. Panel II: Satellite light density is the average pixel shading per sector for different years. Multiple years in a column heading indicates average density over these years. I report standardized coefficients. In both panels, geographical controls include the mean elevation of a sector, the mean slope and the distance to the nearest river, measured from the centroid of the sector. Standard errors in parentheses. * indicates significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table 6: Heterogeneity in state capacity persistence

	Road Density (1)	Road Density (2)	Road Density (3)
Duration of Incorporation	0.000253**	0.000151	0.000213*
	(0.000103)	(0.0000999)	(0.000120)
Number of Schools 1960	0.00151		0.00111
	(0.00177)		(0.00184)
Duration of Incorporation * Number of Schools 1960	-0.0000155		-0.0000126
	(0.0000108)		(0.0000109)
Number of Schools 1980		0.00670	0.00473
		(0.0155)	(0.0166)
Duration of Incorporation * Number of Schools 1980		0.00000141	0.0000137
		(0.000121)	(0.000130)
Observations	383	383	383
R^2	0.021	0.023	0.025

Number of Schools 1960 is the count of primary schools in 1960 in sector i. Number of Schools 1980 is the number of higher education establishments in 1980. All specifications have clustered standard errors at the precolonial district level. Standard errors in parentheses. * indicates significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Appendix 1: Background and data sources

This appendix discusses, in turn, the background of the Hutu/Tutsi distinction and the local accountability hypothesis, the units of measurement used and the sources for the data used in this paper. All Internet URLs were current on the first of March 2013. Table A1-1 below gives the summary statistics for variables that were not listed in table 1.

Hutu and Tutsi

The distinction Hutu/Tutsi first appears first appears in the precolonial Nyiginya army. The Tutsi generally fought and the Hutu were the providers for the fighters. As the nineteenth century wore on, these categories had become economic, Hutus being farmers and Tutsis herders. Furthermore, the king was Tutsi, albeit strictly from two ruling lineages (Verwimp, 2013, p. 2). Yet, Tutsis could 'Hutufy' when they were too poor to be herders and had to farm and Hutus could 'Tutsify' when they grew rich enough to become herders. In fact, Tutsis not from the two ruling lineages were often as poor as Hutus. The Belgians instituted these classes as racial, not economic (Mamdani, 2002), and recorded them in the 1933 census. Ever since, these categories were strict and racism as a result of the cleavage has been pointed at as a reason for the fact that political struggles in Rwanda are so violent (Ibid.). To justify this distinction, the Belgian colonizers appealed to the so-called Hamitic hypothesis. The Hamitic hypothesis prescribes that, since the colonizers encountered a working state, this could not be an African kingdom. Hence, the Tutsi were really white people trapped in a black skin. They were sons of the biblical Ham, the forefather of the noble black people. The noble black people were distinguished from ordinary black people who were regarded as sub human, not descending from any of the sons of Moses. Although an old idea, it was only around the time when Napoleon visited Egypt and marvelled at the ancient wonders that were built by, in their view, remarkably black people that the distinction between different kinds of black people was invented. Before, all black people were thought to descend from Ham (Sanders, 1969). The racial favoritism of the Belgians was prominent in the 1959 coup, which was openly framed as a struggle of the Hutu against the Tutsi oppressors. After the invasion of the RPF, the Tutsi became increasingly portrayed as invaders wanting their historical privileges back, compounding the grievances held by Hutus. This social divide between Hutus and Tutsis gave the Hutus a clear group in society to predate on.

The local accountability hypothesis

Within Rwanda, the local accountability hypothesis seems most plausible, other explanations vary at the national/ethnicity level and can be taken as spatially constant in Rwanda. I provide evidence for this hypothesis from the world values survey. Rwanda was part of the 2005 wave of the survey, surveying 1506 people on a variety of topics, from occupational questions to questions about politics and the role of women in society. In the Rwanda questionnaire, question v71 asks: "If you had to choose, which one of the things on this card would you say is most important?". The second answer, out of four[41], reads: "Giving people more say in important government decisions". I coded the fraction of people that give this answer per prefecture, since this is the lowest level of spatial aggregation available. This gives only twelve observations, so any inference should be interpreted with caution. This question gives insight in the attitudes towards government accountability. Subject to these caveats, figure A1-3 gives scatter plots of of the median duration of incorporation of the precolonial districts that have their centroid in prefecture p against the percentage of people that indicate that the goal of the government should be to grant people more say in prefecture p. The left panel, in line with the analysis above, gives the prefectures that have an above average percentage of Tutsi, the right panel have a below average level of Tutsi.

[insert figure A1-3 about here]

When a prefecture has an above average number of Tutsi, local accountability works as expected. Higher historical state capacity, and hence higher local accountability correlates with a lower desire for accountability. Yet, in prefectures with a below average number of Tutsi, the relationship reverses. One explanation for this observation could be that public goods were explictly directed away from provinces where a greater share of the population was Tutsi (Verwimp, 2013, p. 72).

Administrative units

Figure A1-2 gives maps of the relevant administrative units. At the time of the genocide Rwanda was split up into prefectures, communes, secteurs (top map) and several village level units which I haven't used. The GIS shapefiles for the communes were downloaded from the UN Second level administrative boundaries project and are available at www.unsalb.org. The sector (secteur) shapefiles were made available to me by the National University of Rwanda but can be accessed online at http://41.222.244.11/adminrwanda/.

[41] The other possible answers are: 1) Maintaining order in the nation 3) Fighting rising prices 4) Protecting freedom of speech.

From 2002 the prefectures and communes were superseded by provinces and districts. The shapefiles for these are available at www.gadm.org.

Reconstructing the administrative structure of the Nyiginya kingdom

The year of incorporation is recorded at the level of the (pre)colonial district, see the bottom map in figure A1-1. I have digitalized and combined maps from Vansina (2004) with maps from colonial records (Paternostre de La Mairieu (1972) and Belgium (1952)) to reconstruct this map. Ideally, I would use just Vansina's maps. However, these maps don't include boundaries of the districts, just the name and broad geographical location. I reconstruct the boundaries of each district from the colonial maps. Whenever a name from a Vansina map matched the name on the colonial maps the borders of this map were used. If this wasn't the case the year of incorporation of the district in Vansina overlapping the relevant district in the colonial map was imputed to the district on the colonial map. When a colonial district was part of multiple district in Vansina by, for instance, crossing a river where Vansina had two district on either side the Vansina district of the centroid was used to impute the year. I then go on to compute the duration of incorporation for each districts by subtracting the year of incorporation from 1897.

To compile the year of incorporation for each district I If a precolonial district was explicitly mentioned in Vansina (2004), I use this reference. Vansina rarely gives an exact year since expansion of the kingdom into a certain area is often attributed to a year of the reign of a king. By consulting a kinglist (see table A1-3 below), it is possible to date the incorporation in the kingdom of several, but not all, (pre)colonial districts. For those districts not explicity mentioned in the Vansina, I use the fact that he has four maps of 'snapshots' of the extent of the kingom in 1700, 1796, 1867 and 1897. If a district was indicated to be in the kingdom on, say, the 1867 map, and not on an earlier 'snapshot', the year of incorporation was at the latest 1867, and it was coded as 1867[42].

Table A1-1 below gives the district names as I recorded them from the colonial maps in column (1). Column (2) gives the corresponding district from Vansina, which is matched according to the procedure described above. Column (3) gives the latest year at which the district was incorporated, the 'incorporated by year t' measure described in the text. This measure is compiled from the maps in Vansina that display several cross section of the expanding kingom. If a district is indicated as part of the kingdom on a map

[42]The duration of incorporation is, then, $1897 - 1867 = 30$. The results are robust to using this 'incorporated by year t' measure for the entire sample. See section 4 in the main boldy of the paper as well as the results in table A2-3 in this appendix.

displaying a the extent of the kingdom at year t, then t is recorded in column (3). Column (4) has the relevant page number to Vansina, if the district is mentioned in the text. Column (5) has the name of the reigning king at the time of the incorporation of the district (see the kinglist below). Column (6) gives the measure used as year of incorporation throughout this paper. This measure is reconstructed from the text. Sometimes years of incorporation are explicitly mentioned in the text. Sometimes it is mentioned that district i was incorporated early in the reign of king k. Early was throughout recorded as five years into the reign of king k. If the district is mentioned to have been conquered by king k but no year or indication is given, the last year in which this king was in power is recorded. Column (7) gives a the relevant map in Vansina on which the district in question is displayed. The numbers refer to the maps printed before the introduction that display the kingdom as a central, a western and an eastern part. Map 1 refers to the map of central Rwanda, map 2 refers to the map of eastern Rwanda and map 3 refers to the map of western Rwanda. The list of kings I used to date some of the expansions of the kingdom is found below in table A1-3. The names printed in lower case are the actual names of the kings. The names printed in upper case are the symbolic names, which are often used interchangeably with the actual names.

Reconstruction of the Genocide data

The genocide data were made available to me by David Yanagizawa-Drott. Originally, they were published on the Internet at http://www.inkiko-gacaca.gov.rw/En/EnLaw.htm, but this website is no longer operational. The data, described in section 2, record the convictions for several categories of crimes in the genocide. The data are available at a very finegrained level, even below the sector (see the map of the sectors, below). I have been able to attribute two thirds of the observations at the lower level (call this unit a village for now) to their respective sector. Due common repetition of names, I had to drop one third of the observations. The database records the number of persons convicted by district (a higher level administrative unit bigger than both the sector and the village) and village. Within each district there were usually several villages with the same name. In comparing these names to a database of sectors and their constituent villages, there is no way of attributing the right village to the right sector, since we have both sectors and villages per district but no means of knowing which village belongs to which sector. In the end I aggregated around 1000 observations to 416 sectors. The final sample consists of 383 observations. The loss in observations is mainly due to a change of boundaries in 1996 at the commune level (communes are comparable to districts; they were changed to districts in 2002). The new commune Mutara was formed from sectors from several other communes, most likely from parts of Byumba and Kibungo. As there is no

way to trace the sectors, it is impossible to match the 1991 commune data from the census to the sector data which take their commune attribute from a shapefile drawn in 2002, after the formation of Mutara. Therefore, some sectors will not match and are dropped, resulting in a sample of 383 sectors. When using the cattle suitability as an instrument, the sample consists of 373 sectors, due to missing pasture suitability data. The pasture suitability data are in the form of a raster. This raster has a certain granularity. If a shape (sector) does not contain any raster centroid the suitability data is missing since ArcGIS cannot compute an average over a shape in that case.

The cattle suitability index

The cattle suitability index is given by:

$$CattleSuitabilityIndex = (1 - TseTseSuitability) * PastureSuitability * (1 - TerrainSlope) \in [0, 1] \quad (5)$$

The index is constructed of a measure of the predicted suitability of the Savannah TseTse (the Morsitans species group) and a measure of the suitability for pasture, both compiled by the Food and Agricultural Organization of the UN, and a slope measure. Rwanda is unsuitabile for other TseTse subspecies, such as the forest TseTse. The data were constructed as follows "The modelling process relies on logistic regression of fly presence against a wide range of predictors. The predictor variables include remotely sensed (satellite image) surrogates of climate: vegetation, temperature, moisture. Demographic, topographic and agroecological predictors are also used.". Source is the website of the FAO PAAT program. The prediction was created at a 5 kilometers resolution (source: the example map for the morsitans group at http://www.fao.org/ag/againfo/programmes/en/paat/maps.htm) . After having rescaled all variables to lie between 0 and 1, the index is the product of these three factors. Figure A1-2 gives the densities for the components of the instrument as well as for the instrument itself. Although TseTse suitability is very heavily skewed, the index is approximately normal (mean 0.54, standard error 0.20). It is important to note that the functional form of (2) is not important, summing the factors, taking a weighted average or defining cutoffs for the components and creating a dummy instrument does not alter any of the results in magnitude or significance (see table A2-4).

Other Data

Controls and their sources

Variable	Source	Comment
	Geographical Controls	
Elevation	CGIAR consortium at http://srtm.csi.cgiar.org/	
Slope	Earth Resources Observation and Science Center of the USGUS at http://eros.usgs.gov	
Inland rivers and water bodies	Digital Chart of the World available through www.diva-gis.org	Distances computed in ArcGIS
Main roads	Africover at www.africover.org	Distances computed in ArcGIS
Main towns	Africover at www.africover.org	Distances computed in ArcGIS
Distance to national border		Computed in ArcGIS
Suitability for Tea, Coffee, Bananas and Sorghum	FAO at http://webarchive.iiasa.ac.at/Research/LUC/GAEZv3.0/	I used the rain-fed, low intensity, baseline period settings to select a raster file for downloading
Satellite lights	http://ngdc.noaa.gov/eog/dmsp/downloadV4composites.html	I used the files from the table 'Average Visible, Stable Lights, Cloud Free Coverages'. Then I used the raster that has stable, averaged, visible lights.
	Historical Controls	
Number of missionary stations 1924	www.economics.harvard.edu/faculty/nunn/	Used in Nunn (2010)
Number of missionary stations 1935	Parlement (1935)	
Number of cattle 1960	Belgium (1960)	
Number of coffee pulping centers 1960	Belgium (1960)	
Number of schools 1960 Primary Schools	Scarr (1960)	
Number of schools 1980	Prioul and Sirven (1981)	Secondary education establishments
Location of conflict in the 1959 coup	'Histoire du Rwanda' available at www.nurc.gov.rw	The report cites Lugan (1975) as the source of the map.
Road Density 1988	Rhineland-Palatinate (1981)	

Controls and their sources continued

Variable	Source	Comment
	Other Controls	
Total Population	The 1991 Rwandan Census, available at the IPUMS website international.ipums.org/international/.	Further data on total population from this census can be obtained from the genodynamics project at www.genodynamics.com. Density computed using total area of a commune, computed in ArcGIS using the commune shapefile available at www.unsalb.org. Note that IPUMS only published a 10% of the full sample. Therefore, any normalizations have been carried out using the genodynamics data (which only reports population totals) and controls have been computed from the more complete but sampled IPUMS data.
Number of Tutsi	1991 census	
Number of Burundi	1991 census	
Number employed in military	1991 census	
Number owning a radio	1991 census	
Number illiterate	1991 census	
Number having no education	1991 census	
Postgenocide violence	The Armed Conflict Location Database at http://www.acleddata.com/	
Vaccination data	DHS surveys at www.measuredhs.org	The DHS survey question used is question h2 of the individual data set of the 1992 Rwandan DHS survey. If the date of immunization was indication on an immunization card, the mother of the person in question indicates that this person was immunized or the immunization was marked on a immunization card without a date, this variable gets a 1. If the response was 'no' or 'I don't know' then this question gets a 0. Due to the limited geographic information for this survey, the results were then aggregated to the prefecture level.
Accountability	The World Values Survey at www.worldvaluessurvey.org	

Table A1-1: Summary Statistics

	N	Mean	Standard Deviation	Min	Max
Higher Education 1980	383	1.39	1.28	0	4
Road Density	383	0.12	0.08	0	0.666
Population Density	383	0.002	0.007	0.0002	0.101
Percentage owns radio	383	1.63	0.17	1.18	1.82
Percentage Burundi	383	0.004	0.01	0	0.07
Percentage Military	383	0.004	0.007	0.04	
Percentage no education	383	0.302	0.06	0.1	0.409
Percentage illiterate	383	0.35	0.057	0.12	0.45
Distance to nearest river	383	6.26	4.26	0.01	24.04
Distance to nearest town	383	22.46	15.12	0.9	89.9
Distance to nearest major road	383	6.78	6.17	0.01	39.06
Distance to country border	383	23.30	14.52	0.14	52.68
Violence 1959	383	0.03	0.16	0	1
Post genocide violence	383	1.15	4.52	0	55
Missionary stations 1924	383	0.07	0.39	0	4
Missionary stations 1935	383	0.12	0.41	0	4
Number of schools 1960	383	5	4.76	0	30
Number of coffee pulping centers 1960	383	0.84	1.27	0	9
Number of cattle head 1960	383	3.44	3.79	0	28
'Incorporated by year t'	383	1817	61	1700	1897
Category 3 convictions	383	600	644	0	4310
Category 2 convictions	383	854	810	0	4255
Category 1 convictions	383	151	174	0	1095
Tea Suitability	383	54	23	.	95
Coffee Suitability	383	28	13	0	54
Banana Suitability	383	8	14	0	79
Sorghum Suitability	383	28	16	0	64
Satellite Light Density 1993	383	1.7	7	0	52
Satellite Light Density 1994	383	0.6	2.9	0	25
Satellite Light Density 1995	383	1.4	5.8	0	45
Satellite Light Density average 92/93	383	1.6	7.3	0	52
Satellite Light Density average 95/96	383	1.4	6.3	0	48
Satellite Light Density average 92/00	383	1.5	6.4	0	48

Data sources are given above.

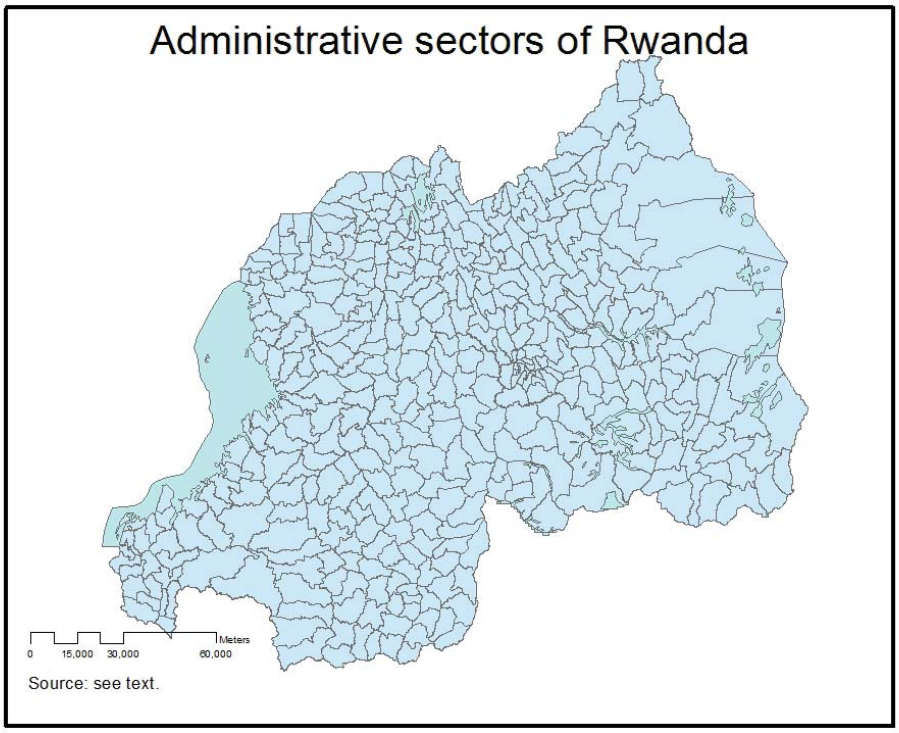
Table A1-2: Precolonial Districts

Colonial District (1)	Vansina District (2)	'by year t' year (3)	Page (4)	King (5)	Year of Incorporation (6)	Map (7)
Biru	Biru	1867	153		1867	3
Buberuka	Buberuka	1897	178		1897	2
Rukiga	Buberuka	1897	178		1897	2
Budaha	Budaha	1796	114	Mazimpaka	1766	1
Bufundu	Bufundu	1796	116	Rujugira	1775	1
Buganza	Buganza	1796	118	Rujugira	1771	2
Bugoyi	Bugoyi	1867	159	Rujugira	1786	3
Bugusera	Bugusera	1867	124	Sentabyo	1799	1
Buhanga/Ndara	Buhanga and Ndara	1720	50	Gisanura	1720	1
Buhema	Buhoma	1867	153		1867	3
Bukonya	Bukonya	1796	125	Sentabyo	1796	1
Cyesha	Bukunza	1897				
Bumbogo	Bumbogo	1700	46	Ndori	1700	1
Nyaruguru	Bungwe	1796	124		1796	1
Bunyambiriri	Bunyambiriri	1796	116	Rujugira	1766	1
Ndiza	Burembo	1796	114	Gisanura	1735	1
Bumbogo	Buriza	1796	46	Ndori	1700	2
Busanza	Busanza	1720	50	Gisanura	1720	1
Bushiru	Bushiru	1867	153		1867	3
Buliza	Busigi	1700	46	Ndori	1700	1
Bukunzi	Busozo	1897	178		1897	3
Busozo	Busozo	1897	178		1897	3
Buyaga	Buyaga	1897	178		1897	2
Buyenzi	Buyenzi	1897	157	Rwabugiri	1872	1
Bwanacyambe	Bwanacyambe	1796	50	Gisanura	1720	1
Bashumba-Nyakare	Bwanamukari	1796	124		1796	1
Mwejuru	Bwanamukari	1796	124		1796	1
Rusenyi	Bwishaza	1867	160	Rwogera	1845	3
Kingogo	Cyingogo	1867	124		1796	3
Gihunya	Gisaka	1867	155	Rwogera	1850	3
Impara	Impara	1867	153		1867	3
Kabagari	Kabagari	1700	49	Ndori	1700	1
Kanage	Kanage	1867	153	Rwogera	1867	1
Kibari	Kibari	1796	125	Sentabyo	1796	1
Cyesha	Kinyaga	1867	160	Sentabyo	1801	3
Marangara	Marangara	1796	124		1796	1
Mayaga	Mayaga	1700	49	Ndori	1700	1
Migongo	Migongo	1867	153		1867	2
Mubari	Mubari	1897	178		1897	2
Bugarura	Murera	1867	159	Gahindiro	1845	1
Mulera	Murera	1867	159	Gahindiro	1845	1
Buganza North	Mutara	1897	1895	Rwabugiri	1895	
Mutara	Mutara	1897	1895	Rwabugiri	1895	
Ndiza	Ndiza	1796	114	Gisanura	1735	1
Ndorwa	Ndorwa	1897	167	Rwabugiri	1868	
Nduga	Nduga	1700	49	Ndori	1700	1
Nyantango	Nyantango	1796	114	Mazimpaka	1766	1
Rukaryi	Rukaryi	1796	124		1796	2
Rukoma	Rukoma	1700	49	Ndori	1700	1
Bwishaza	Rusenyi	1867	153		1867	3
Rwankeri	Rwankeri	1867	153		1867	3
Bukamba	Yomba/Jomba	1867	159	Gahindiro	1845	3

Table A1-3: List of Kings

RUGANZA Ndori	around 1650
Some unknown kings	
MIBAMBWE Gisanura	after 1700-1735
YUHI Mazimpaka	1735-1766
KAREMERA Rwaka	1766-1770
CYIRIMA Rujugira	1770-1786
KIGERI Ndabarasa	1786-1796
MIBAMBWE Sentaboyo	1796-1801
YUHI Gahindiro	1801-1845
MUTARA Rwogera	1845-1867
KIGERI Rwabugiri	1867-1895
MIBABMWE Rutarundwa	1895-1897
YUHI Musinga	1897-1931

Figure A1-1: Geographical units



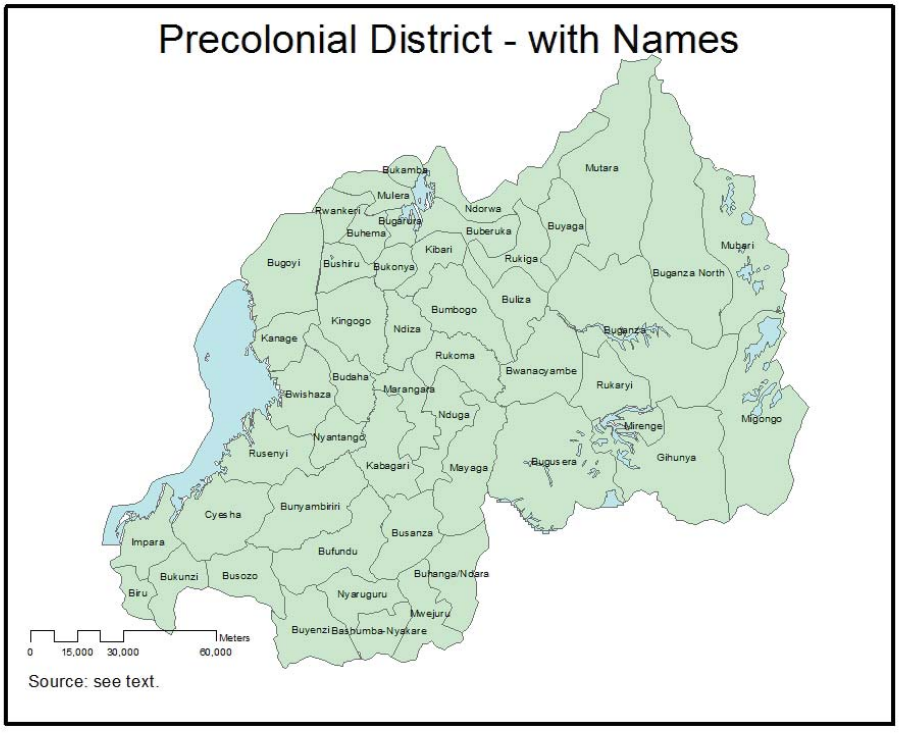
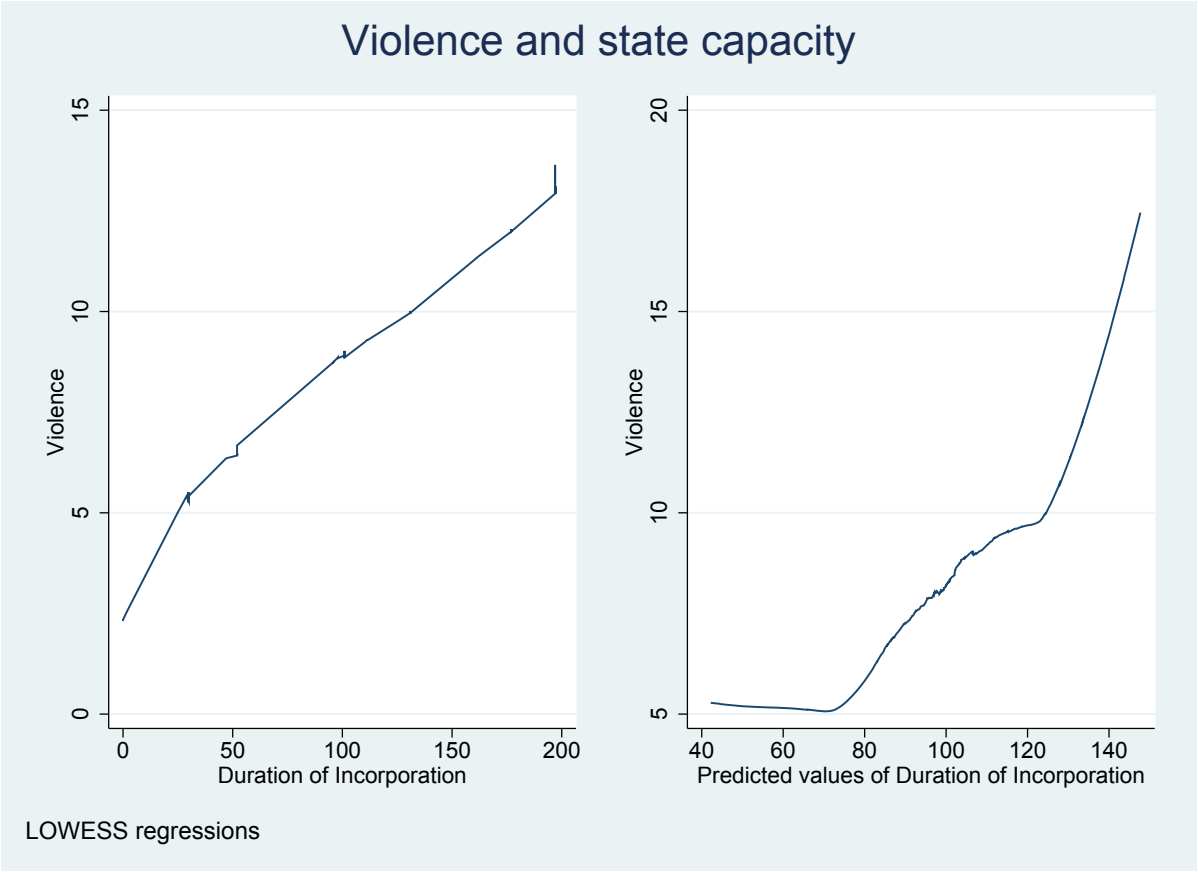


Figure A1-2: LOWESS regressions



Non-parametric LOWESS estimates of the relationship between the duration of incorporation and violence as well as between the predicted values of the duration of incorporation from the first stage on violence. Both estimates point to a linear model as the best approximation the relationships in the data. For the right graph, a formal Box-Cox test fails to reject a linear model (p-value: 0.174).

Figure A1-3: Components of the cattle suitability index

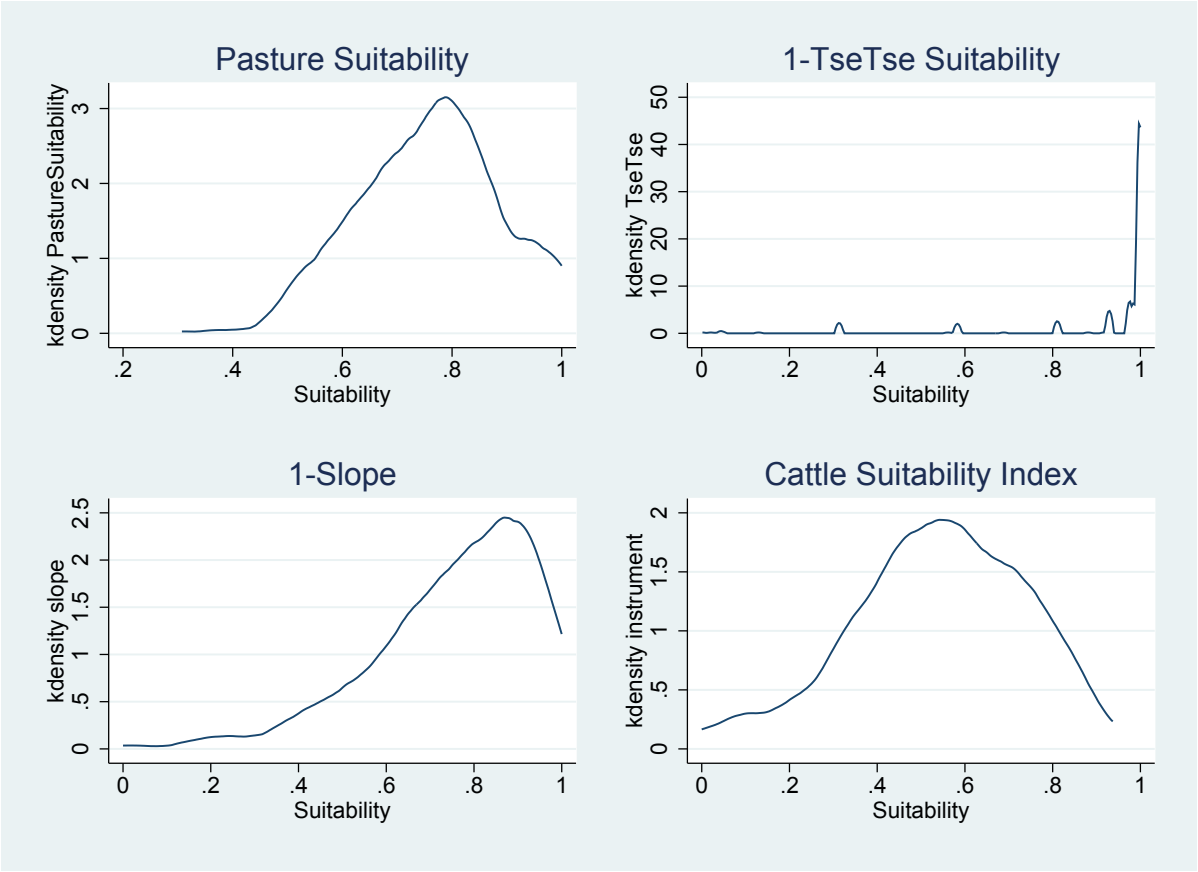
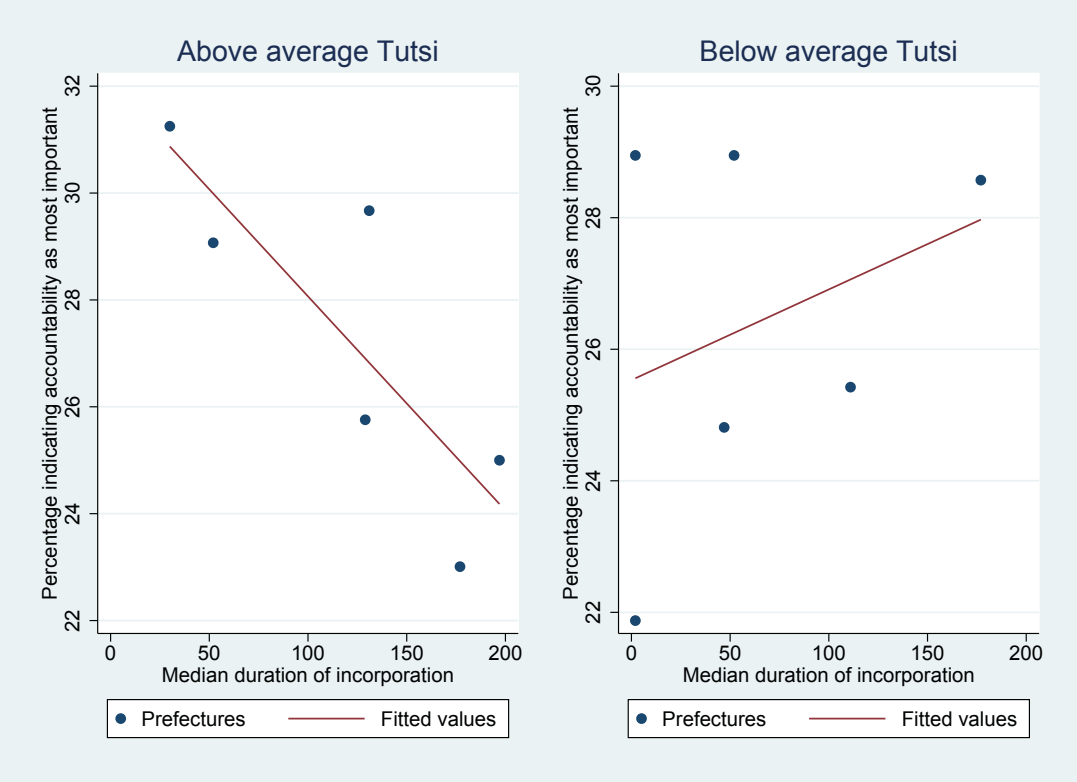


Figure A1-4: Accountability



Appendix 2: Tables

Table A2-1 provides evidence on the sensitivity of the main result to changing the dependent variable. Columns (1-3) repeat column (3) from table 1 and use as a dependent variable the categories of Gacaca convictions mentioned in the text. Column (4) uses the sum of these categories. Throughout the above, the main dependent variable was this sum normalized by area. Columns (4-7) repeat columns (1-3) in table 1 with the dependent variable replaced with a variable called 'Factor', which is the result of a principle component analysis of the three Gacaca categories.

Table A2-2 provides evidence on the exclusion restriction as well as a repetition of the GMM results in table 2 using the distance to Gasabo, the mythical hill where the Nyiginya kingdom was founded, as an instrument.

Table A2-3 provides evidence on the sensivity of the main result to using a different measure of the duration of incorporation. I also provides evidence on the sensitivity of the result to the functional form of the cattle suitability index. Columns (1-6) repeat columns (1-6) of table 1 with Duration of Incorporation replaced by Alternative duration of incorporation which measures year of incorporation by the 'incorporated by year t' measure, reconstructed from the cross section maps in Vansina (see full description in text). Columns (7-9) repeat column (5) of table 1 with different specifications of the cattle suitability index.

Table A2-4 provides evidence of the robustness of the main result to including a large range of controls. All columns repeat column (3) of table 2.

Table A2-5 provides evidence of the robustness of the IV result. All columns repeat column (6) of table 2.

Table A2-6 repeats table 4 but omits the duration of incorporation.

Table A2-1: Alternative verions of the main dependent variable

	Category 1 (1)	Category 1 (2)	Category 2 (3)	Category 2 (4)	Category 3 (5)	Category 3 (6)	Total Violence (7)	Factor (8)	Factor (9)	Factor (10)
Duration of	0.209	0.711***	2.042***	3.980***	1.551***	4.348***	3.802***	0.00547***	0.00415***	0.00214***
Incorporation	(0.139)	(0.261)	(0.684)	(1.260)	(0.562)	(1.360)	(1.196)	(0.000690)	(0.00153)	(0.000711)
Percentage Tutsi	328.6**	667.9***	978.6	2893.8***	-339.1	1159.3	968.1		4.459***	0.954
	(124.2)	(210.8)	(610.6)	(1018.8)	(407.6)	(763.0)	(1034.9)		(0.974)	(0.631)
Distance to Kigali	-2.911**	0.0614	-7.529	1.289	-8.669**	2.912	-19.11*			-0.0126*
	(1.420)	(0.614)	(5.808)	(3.447)	(4.155)	(2.896)	(10.83)			(0.00695)
Geographical Controls	Y	Y	Y	Y	Y	Y	Y	N	N	Y
Distance Controls	Y	Y	Y	Y	Y	Y	Y	N	N	Y
Fixed Effects	Y	N	Y	N	Y	N	Y	N	N	Y
Clustered se	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
N	383	383	383	383	383	383	383	383	383	383
R^2	0.521	0.280	0.598	0.345	0.578	0.240	0.613	0.141	0.257	0.610

OLS regression. The dependent variables are the non-normalized categories of crimes from the Gacaca records in (1)-(6). The categories are outlined in the text. Column (4) has the absolute value of the violence convictions instead of the normalized values in the text. These columns repeat column (3) from table 2. The dependent variables in columns (5)-(8) are the result of a factor analysis (principle components) of the three categories. These columns repeat columns (1-3) from Table 2. Fixed effects are at the level of the modern district. Geograpical controls include the mean elevation and the terrain slope of a sector, measured under the centroid. Distance controls include distance to the border, distance to the nearest road and distance to the nearest river. Standard errors are, if clustered, clustered at the precolonial district level. * indicates significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table A2-2: The exclusion restriction and and distance to Gasabo instrument

	Wealth			Agricultural Suitability			Instrument: Distance to Gasabo hill		
	Violence (1)	Violence (2)	Violence (3)	Violence (4)	Violence (5)	Violence (6)	Violence (7)	Violence (8)	Violence (9)
Duration of Incorporation	0.0742***	0.103***	0.0903**	0.105***	0.0955***	0.0771**	0.104***	0.0762***	0.0830***
	(0.0287)	(0.0285)	(0.0362)	(0.0382)	(0.0303)	(0.0382)	(0.0119)	(0.0187)	(0.0141)
Percent Tutsi	25.53**					29.10***		23.40**	15.10*
	(11.80)					(7.667)		(9.988)	(8.302)
Mean Satellite Light Density at night for 1992		-0.322***				-0.375***			
		(0.0627)				(0.106)			
Number of 500 cattle in 1960			0.190			0.164			
			(0.291)			(0.224)			
Banana Suitability				-0.0213		0.0172			
				(0.0764)		(0.0526)			
Coffee Suitability				-0.0773		-0.200**			
				(0.187)		(0.0993)			
Sorghum Suitability				0.0672		0.166*			
				(0.165)		(0.0898)			
Tea Suitability				-0.0161		0.00135			
				(0.0547)		(0.0370)			
Number of Coffeepulping Centers					0.233	-0.0982			
					(0.608)	(0.330)			
Distance to Kigali							0.0877***	0.0554*	0.0539*
							(0.0175)	(0.0288)	(0.0279)
Geographical Controls	N	N	N	N	N	Y	N	N	Y
Distance Controls	N	N	N	N	N	Y	N	N	Y
Clustered se	Y	Y	Y	Y	Y	Y	N	Y	Y
Observations	373	373	373	373	373	373	373	373	373
R^2	0.051	0.166	0.045	0.000	0.007	0.275	0.066	0.204	0.244

GMM regressions. Distance controls include distance to the border, distance to the nearest road and distance to the nearest river. Standard errors are, if clustered, clustered at the precolonial district level. * indicates significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table A2-3: Incorporated by year t measure of duration of incorporation and alternative instrument specifications

	OLS			IV			different forms IV		
	Violence (1)	Violence (2)	Violence (3)	Violence (4)	Violence (5)	Violence (6)	Violence (7)	Violence (8)	Violence (9)
Alternative duration of incorporation	0.0522*** (0.00606)	0.0414*** (0.00934)	0.0312*** (0.0110)	0.122*** (0.0247)	0.0960** (0.0470)	0.0589** (0.0244)			
Duration of Incorporation							0.0647** (0.0263)	0.0924** (0.0453)	0.0318* (0.0169)
Percent Tutsi		35.45*** (9.098)	1.414 (7.471)		23.46* (12.93)	21.71** (9.482)	27.97** (11.09)	20.86 (15.17)	36.40*** (9.507)
Distance to Kigali			-0.0584 (0.0506)			0.0427* (0.0231)			
Geographical Controls	N	N	Y	N	N	Y	N	N	N
Distance Controls	N	N	Y	N	N	Y	N	N	N
Fixed Effects	N	N	Y	N	N	Y	N	N	N
Clustered se	N	Y	Y	N	Y	Y	Y	Y	Y
Observations	373	373	373	373	373	373	373	373	373
R^2	0.166	0.266	0.502	0.0000	0.095	0.321	0.204	0.204	0.250

The dependent variable is the normalized violence from the Gacaca courts used throughout this paper. Instead of using the year of incorporation from Vansina(2004) I reconstructed, this table uses years measure at several points in time: 1700, 1720, 1796, 1867, 1897. If precolonial district i is indicated to be in the kingdom by year t, this year is coded as year of incorporation. The taken form several maps in Vansina. Columns (7-9) repeat column (5) from table 2 with different functional forms for the cattle suitability index. Column (7) sums the elements of the cattle suitability index. Column (8) uses a weighted average of the three elements with 1/3 weight on terrain slope, 1/2 weight on pasture suitability, and 1/6 on TseTse unsuitability. Changing these weights does not substantially change the results. Column (9) uses the products of three dummies that are created from the elements of the cattle suitability index. The cutoff for slope is set at 1000 (or 10 degrees). The cutoff for TseTse is set at its mean. The cutoff for pasture suitability is set such that all observations are included since there is no natural cutoff for this variable. Fixed effects are at the level of the modern district. Distance controls include distance to the border, distance to the nearest road and distance to the nearest river. Standard errors are, if clustered, clustered at the precolonial district level. * indicates significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table A2-4: Controls

	Violence (1)	Violence (2)	Violence (3)	Violence (4)	Violence (5)	Violence (6)	Violence (7)
Duration of Incorporation	0.0247**	0.0278***	0.0278***	0.0275***	0.0274***	0.0269***	0.0247**
	(0.00924)	(0.00934)	(0.00934)	(0.00927)	(0.00929)	(0.00927)	(0.00937)
Percentage Tutsi	10.74	10.49	9.704	9.651	9.595	8.647	10.63
	(7.730)	(7.764)	(7.961)	(7.927)	(7.959)	(7.718)	(7.468)
Distance to Kigali	-0.0295	-0.0456	-0.0509	-0.0518	-0.0569	-0.0425	-0.0184
	(0.0403)	(0.0408)	(0.0416)	(0.0410)	(0.0439)	(0.0399)	(0.0414)
Number of cattle 1960	0.299**						0.299**
	(0.126)						(0.124)
Number of hospitals 1935		2.080**					1.889*
		(0.958)					(1.004)
Number of missionary stations 1935			0.506				0.413
			(0.642)				(0.662)
Number of missionary stations 1924				0.147			-0.405
				(0.510)			(0.572)
TseTse suitability					1.834		1.273
					(2.131)		(2.319)
Mean Elevation						-0.00269	-0.00239
						(0.00177)	(0.00167)
N	383	383	383	383	383	383	383
R^2	0.478	0.472	0.467	0.467	0.467	0.471	0.488

OLS regressions. All regressions include fixed effects at the level of the modern district. All regressions include standard errors that are clustered at the precolonial district level. * indicates significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table A2-4: Controls continued

	Violence (1)	Violence (2)	Violence (3)	Violence (4)	Violence (5)	Violence (6)	Violence (7)	Violence (8)
Duration of Incorporation	0.0284***	0.0267***	0.0259***	0.0250**	0.0329***	0.0287***	0.0287***	0.0265**
	(0.00931)	(0.00939)	(0.00879)	(0.00980)	(0.00984)	(0.00882)	(0.0101)	(0.0102)
Percentage Tutsi	10.67	9.626	8.970	7.942	6.136	5.165	0.903	3.324
	(7.998)	(7.975)	(7.971)	(7.866)	(7.863)	(7.706)	(7.872)	(7.378)
Distance to Kigali	-0.0508	-0.0527	-0.0323	-0.0605	-0.0420	-0.0769*	-0.0552	-0.0253
	(0.0422)	(0.0417)	(0.0518)	(0.0435)	(0.0417)	(0.0406)	(0.0542)	(0.0544)
Pasture Suitability	0.000491*						0.000293	[controls
	(0.000268)						(0.000345)	from both tables A2-4]
Slope		-0.000864					-0.000376	
		(0.00121)					(0.00121)	
Distance to country border			0.0461				0.0614	
			(0.0524)				(0.0584)	
Distance to nearest road				-0.141			-0.111	
				(0.0935)			(0.0973)	
Distance to nearest town					-0.0911*		-0.0756*	
					(0.0479)		(0.0416)	
Distance to nearest river						0.274***	0.304***	
						(0.0853)	(0.0974)	
N	373	383	383	383	383	383	373	373
R^2	0.470	0.467	0.467	0.472	0.471	0.480	0.495	0.509

OLS regressions. All regressions include fixed effects at the level of the modern district. All regressions include standard errors that are clustered at the precolonial district level. * indicates significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table A2-5: IV with controls

	Violence (1)	Violence (2)	Violence (3)	Violence (4)	Violence (5)	Violence (6)	Violence (7)	Violence (8)
Duration of Incorporation	0.0751*	0.155	0.0840**	0.0857**	0.0825**	0.0817**	0.0728***	0.110**
	(0.0431)	(0.0945)	(0.0398)	(0.0382)	(0.0364)	(0.0353)	(0.0271)	(0.0527)
Percentage Tutsi	21.29	5.990	20.32	20.47	25.10*	16.59	24.02*	15.09
	(13.74)	(24.69)	(13.97)	(14.44)	(13.07)	(14.17)	(12.42)	(14.34)
Distance to Kigali	0.0604	0.135	0.0625	0.0649	0.0478	0.0730	0.0502	0.0820
	(0.0457)	(0.105)	(0.0487)	(0.0494)	(0.0445)	(0.0485)	(0.0374)	(0.0553)
Number of cattle 1960	0.296							-0.0115
	(0.236)							(0.240)
TseTse suitability		-10.73						-6.865
		(7.723)						(4.253)
Number of schools 1960			0.146					0.0991
			(0.178)					(0.155)
Number of missionary stations 1935				0.736				0.515
				(0.882)				(0.820)
Population Density					-227.0***			-201.9***
					(49.02)			(62.81)
Mean Elevation						-0.00407**		-0.00323*
						(0.00164)		(0.00196)
Pasture Suitability							2.601	2.705
							(3.502)	(4.443)
N	373	373	373	373	373	373	373	373
R^2	0.227	0.0000	0.186	0.173	0.219	0.206	0.216	0.138

All regressions are two stage least squares with the cattle suitability index as instrument. All regressions include standard errors that are clustered at the precolonial district level. * indicates significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table A2-6: Alternative Explanations without year of incorporation

	Violence (1)	Violence (2)	Violence (3)	Violence (4)	Violence (5)	Violence (6)	Violence (7)	Violence (8)	Violence (9)
Number of Schools 1960	0.187*								0.126
	(0.102)								(0.112)
Number of Coffeepulping Centers		0.622***							0.465*
		(0.209)							(0.258)
Percent Literate			1.000						11.29
			(18.05)						(13.39)
Percent employed in Military				-36.36					-57.58
				(52.32)					(54.99)
Percent Burundi					-77.06				-44.04
					(47.87)				(40.82)
Percent owns Radio						3.480			0.297
						(8.131)			(6.264)
Population Density							-180.7***	-192.6***	-193.5**
							(28.83)	(32.38)	(76.64)
Percent Tutsi								13.16	
								(7.856)	
Observations	383	383	383	383	383	383	383	383	383
R^2	0.447	0.446	0.439	0.440	0.443	0.440	0.453	0.460	0.469

All regressions include fixed effects at the level of the modern district. All regressions include standard errors that are clustered at the precolonial district level. * indicates significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.