

# The Long-term Impact of Colonial Rule: Evidence from India \*

Lakshmi Iyer<sup>†</sup>

## JOB MARKET PAPER

November 14, 2002

### Abstract

Does colonial rule affect long-term economic outcomes? I answer this question by comparing areas in India which were under direct control of British administrators with areas which were ruled by Indian rulers and only indirectly controlled by the colonial power. OLS results in this context are likely to be biased due to selection bias in British annexation. I take advantage of a specific annexation policy of the British to construct an instrumental variable estimate of the impact of colonial rule. I find evidence that colonial annexation policy was highly selective and concentrated on areas with high agricultural potential. The IV estimates show that areas under direct British rule have significantly lower levels of public goods in the present period. Data from earlier periods indicate that the public goods differences were present in the colonial period itself, and are narrowing over time in the post-Independence period.

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\*I am grateful to Daron Acemoglu, Abhijit Banerjee and Esther Duflo for valuable advice and guidance throughout this project. I thank Josh Angrist, Simon Johnson, Kaivan Munshi, Rohini Pande, Marko Terviö and seminar participants at the Australian National University and the MIT Development and Organizational Economics lunches for extremely helpful comments. I also thank the MacArthur Foundation for financial support and Esther Duflo for generously sharing her code for the randomization inference procedure.

<sup>†</sup>Department of Economics, MIT. lakshmi@mit.edu

# 1 Introduction

The expansion of European empires starting at the end of the 15th century has been an important feature of world history. In the beginning of the 20th century, large parts of Africa and Asia were still colonies of European powers. The link between colonialism and economic underdevelopment has been highlighted by several authors (see Frank (1978) or Bagchi (1982)). The literature has emphasized factors such as excessive exploitation of colonies, drain of resources or the growth of a “dependency” complex. Other authors (e.g. Herbst (2000) on Africa or Roy (2002) on India) are of the view that resource endowments or area characteristics are the major determining forces of long-term outcomes, and that colonial rule plays only a minor part. More recently, emphasis has been laid on institutions created by colonial powers which have persistent effects (Engerman and Sokoloff (1997,2000); Acemoglu, Johnson and Robinson (2001, 2002); Banerjee and Iyer (2002)). However, the latter do not provide any evidence on the net impact of being ruled by a colonial power, since they do not include comparisons with areas which were not European colonies.

The answer to whether a history of colonialism affects long-term outcomes is potentially very important for two reasons. First, it is important to know whether historical incidents have long-lasting effects and more importantly, how long these effects last. This is related to the debate on convergence: are all countries on a path of convergence to the same steady state, or does history prevent convergence? Second, if we can identify certain aspects of colonialism which are responsible for present outcomes, we would have some guidelines with regard to policy choices or choices regarding governance structures. In particular, we can think of a colonial history as a change in the governance structure of a country, the major change being the identity of the policy-maker.

In trying to evaluate the long-term impact of colonialism, a distinction needs to be made between the direct and the indirect impact. Areas or countries which were not colonies themselves are nevertheless likely to be affected by the presence of colonialism as a shaping force in the world. For instance, non-colonies might be able to borrow technologies or copy institutions from colonial areas if they come into contact with colonial powers. Alternatively, non-colonies might be driven to compete with colonial powers (militarily or otherwise), affecting their long-term outcomes even if they were not ruled by any colonial power. In this sense, it is very difficult, if not impossible, to answer the question of what outcomes would have been had European countries never established vast overseas empires.

Even if we want to answer the more limited question of whether the direct impact of colonial-

ism is different from the indirect effect, we are faced with the problem of selection: what determines whether a country became a colony or not? For instance, in terms of per capita GDP in 1995, the poorest twenty countries in the world are all ex-colonies (mostly in Africa). Are they poor today because they were colonies in the past, or is it because they were “inherently” poor that they were ill-defended and easily conquered by colonial powers? It is difficult to think of a way to separate out this selection effect from the causal effect of colonialism in cross-country data.

In this paper, I examine the colonial experience of one country, India, and estimate the differential impact of British colonialism on directly ruled areas compared to areas under indirect control of the colonial power. I am able to solve the selection problem by using specific policies of British colonial rule in India. It is worth emphasizing that given the possibility of spillover effects from colonies to non-colonies, it is impossible to say what outcomes would have been had the British never established any colonies in India. The precise question I answer is: given that the British established a colonial state in India, did it have a differential long-term effect on areas they directly controlled compared to the areas which they did not directly control?

British political control over the Indian subcontinent (present-day countries of India, Pakistan and Bangladesh) began in 1757 and lasted until 1947. However, not all areas of India were directly under British administrative control; there were large areas which were under the administration of Indian rulers (or “native princes” as they were known). The relationship between British India and these “native states” was based on the principle that sovereignty is “divisible”: the defence and foreign policies of the native states were completely controlled by the British, but they enjoyed considerable autonomy in matters of internal administration. The major impact of colonialism was thus to change the identity, and perhaps the incentives, of the person in charge of internal administrative policy: in the British areas it was usually a British-appointed administrator, while in the native states it was a hereditary king. All native states were integrated into independent India after the British left in 1947.

There are several advantages to restricting attention to one country: first, the extent of omitted variables bias is likely to be less than in a cross-country sample. Second, the history of British policy in India provides an exogenous source of variation in the likelihood of becoming a British colony, which enables me to correct for the selection of states into the British empire. Third, since the areas under direct and indirect colonial rule were integrated after 1947, it is more likely that differences in historical rather than current institutions drive my results. Fourth, given that

the British controlled the foreign and defence policies of native states, any differences I observe are most likely to be due to the quality of internal administration.

My empirical strategy is the following: I match present Indian districts to either the British Indian districts or native states they were part of during the colonial period. I then compare these two types of areas in the post-Independence period. I find that former British areas have significantly higher agricultural investments and productivity in the 1956-87 period, and somewhat lower levels of public goods availability in 1981 and 1991. In this comparison, I am unable to distinguish between a positive causal impact of British rule (perhaps due to introduction of better technology or prior investments during the Colonial period itself), and the possibility that only the most productive areas might have been annexed to form the British empire.

To obtain an exogenous determinant of British empire status, I take advantage of a specific British policy : between 1848 and 1856, the British Governor-General Lord Dalhousie refused to recognize adoptions by native rulers and annexed some states where the native ruler died without a natural heir. The native state was said to have “lapsed” and this policy became known as the “Doctrine of Lapse”. This policy enables me to use the death of a ruler without an heir in the specific period of 1848 to 1856 as an instrument for becoming part of the British empire. The validity of the instrument is based on the assumption that the death of a ruler without an heir, in this specific period of time, is likely to be a matter of circumstance and unlikely to have a direct impact on outcomes in the post-Independence period.

I find that the OLS results are heavily biased by selectivity in British annexation: the instrumental variable estimates show that British areas are not significantly better in terms of agricultural investments and productivity, but they have significantly lower availability of public goods like schools, health centers and roads at the village level in the post-Independence period. This is consistent with a scenario where the British annexed areas with the greatest agricultural potential, but did not invest as much as native states in the provision of public goods. I perform several robustness checks for the IV estimates, including a “falsification exercise” where I consider deaths of rulers without natural heir in a different period when the “Doctrine of Lapse” had been officially abandoned by the British (so that death would not result in becoming part of the British empire), and I find no significant differences here.

Using data from earlier periods, I find some indications that the public goods differences I observe reflect differences present in the colonial period, and that British empire and native state

areas are converging over time in the post-Independence period. These results are consistent with the idea that the incentives of rulers to invest in public goods was different in the colonial period, with the advantage going to the non-British areas. The differences in outcomes are slowly eroded after Independence, when both types of areas are governed by the same system of government.

The rest of the paper is organized as follows: section 2 describes the British colonial experience in India and section 3 describes the data and empirical strategy. Section 4 presents OLS results and section 5 describes the instrumental variables strategy and provides estimates of the causal impact of British rule. Section 6 discusses possible interpretations of the results and provides some additional evidence and section 7 concludes the paper.

## 2 Historical Background

### 2.1 The British Empire and the Native States

The British empire in India lasted nearly 200 years. The English East India Company started trading activities in India in the early seventeenth century; in 1613, they received a permit to build their first factory in Surat. The East India Company's victories in the battle of Plassey in 1757 and the battle of Buxar in 1764 gave them political control over the eastern states of Bengal and Bihar, and laid the foundations of the British empire in India. Over the next hundred years, several areas were annexed to the British empire: many coastal regions of southern India were annexed by 1800, parts of northern India (the North-West Provinces), western India (Bombay Presidency) and central India became part of the British empire before 1820. Assam was conquered in the 1820's and Punjab in 1849. Among the last areas to be annexed (in the 1850's) were the northern native state of Oudh and the central Indian areas of Nagpur and Berar. In 1858, the administration of India was taken over by the British Crown from the East India Company and there were no further annexations.

Table 1 shows the growth of the British empire over time.<sup>1</sup> As the table shows, not all annexations were by conquest: several districts were ceded or granted to the British by native rulers (usually for non-payment of tribute or debts). Towards the middle of the nineteenth century, we also see some areas being annexed on account of misrule by native rulers or on account of "lapse" or death of the ruler without a natural heir.

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<sup>1</sup>The one district annexed after 1858 is Panchmahals which was ceded by the ruler of Gwalior to the British in exchange for some other territory.

When the annexation policy was officially abandoned in 1858, there were large areas of India which were still ruled by Indian rulers and continued to be so till the end of British rule in 1947. The map in Figure 1 shows the geographic distribution of these areas. These areas were referred to as “native states” or “princely states” by the Colonial government. We will be using the terminology “native states” throughout the paper. Native states constituted about 45% of the total area and about 23% of the total population in 1911.<sup>2</sup> About 680 big and small states were recognized by the Foreign Office in 1910 and there were about 560 native states within the boundaries of modern India when the British left in 1947 (the rest were in modern Pakistan, Bangladesh and Burma). All the native states within India were integrated into independent India after 1947.

What exactly was a native state? The Interpretation Act of 1889 defines “British India” as “all territories and places within Her Majesty’s dominions which are for the time being governed by Her Majesty through the Governor-General of India”. Sir William Lee-Warner (1910) defines a native state as “a political community, occupying a territory in India of defined boundaries, and subject to a common and responsible ruler who has actually enjoyed and exercised, as belonging to him in his own right duly recognized by the supreme authority of the British Government, any of the functions and attributes of internal sovereignty.” In practice, this mostly meant that native states were those which had been recognized by the British as such. As the Imperial Gazetteer (Hunter et. al. 1908) says “Whether or not a so-called Native State is what it professes to be is a question of fact which, in the absence of a legal decision, must be settled by the present action of the British paramount power.” However, a major defining feature can be said to be “the personal rule of the chief and his control over legislation and the administration of justice”. In 1877, the largest and most important states were designated by the British as “salute states” and the rulers were entitled to a ceremonial gun salute. Appendix Table 1 lists details of the major native states in our data set.

All native states had, by 1818, accepted the British as the “Paramount Power” in India. This meant that all of them were politically subordinate to the British, and did not have the power to make foreign or defence policy decisions independently. Many of them had signed treaties with the British which regulated the size of the armed forces the princes could maintain and several native states also had British forces stationed within their territory. Most of the native states also had annual tribute obligations to the British government (or in some cases to another native state): for

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<sup>2</sup>Figures computed by author after excluding Burma and Sind.

the native states in our data set, the tribute varied from zero to 28% of state revenue in 1896.

Native states varied considerably in all dimensions. Some native states recognized by the British consisted of only a few villages (e.g. several states in Kathiawar region), while the largest native state Hyderabad had an area of 98,000 square miles. In terms of geography (see map), native states were present in all parts of India, though the size distribution was different: central India and the western state of Gujarat had very large numbers of small states, while in the west and south, there were fewer and larger states. The majority of rulers were Hindu kings, though there were several Muslim and Sikh rulers as well. In matters of internal administration, they had varying degrees of autonomy. The British classified states into three classes, of which the first class states had the maximum sovereign powers (including that of the death penalty over their own subjects, though not over British subjects). Native states of a lower class had more limited judicial powers. Native states also varied considerably with regard to their systems of administration and revenue-collection, their currency, legal codes, law enforcement and justice systems. Over time, some states adopted the systems prevailing in British India, though the British usually did not force them to do so but waited instead for “the willing cooperation of the Native princes”. After the integration of native states into independent India, both types of areas have a common system of administration, based on the British Indian model.

## **2.2 British Policy towards Annexation of Native States**

British policy towards the annexation of native states into the British empire varied over time and was heavily influenced by the views of different Governor-Generals. However, three broad stages of policy can be demarcated:

*Policy of the “ring-fence” (1765-1818):* In the initial period, the dominant policy was of non-intervention : the East India Company did not wish to annex too much territory under their own administration both because they were numerically and politically weak and also because they wanted to maintain a “ring-fence” between their areas and the stronger empires of the Marathas and the Sikhs. For instance, Clive decided not to annex Oudh and Delhi in 1765, when he could have done so after the military victory in the Battle of Buxar.

Between 1798-1800, Lord Mornington (later Wellesley) conquered and annexed several areas which became the Madras Presidency in southern India. He also started the system of signing “subsidiary treaties” with several native states, in which the East India Company undertook to

protect the state from external attack in return for the control of its foreign relations. For this purpose it provided a “subsidiary” force of company troops, which were paid for by the native ruler, often by ceding certain territories. Wellesley annexed several areas in lieu of payment for subsidiary troops.

The armies of the East India Company also defeated several rulers of northern and central India in a series of battles in 1802-1804. However, Wellesley was recalled in 1805 due to the East India Company’s opposition to rising military expenditure. The next two Governor-Generals, Cornwallis and Barlow, reverted to a policy of non-interference and many conquered areas were returned to Indian rulers after the signing of peace treaties. Over the next few years, the British made no major annexations, though they did extend their treaty relations with several states, mainly in the western state of Gujarat and in central India.

Lord Hastings took over as Governor-General in 1813, when a group of raiders called the Pindaris were raiding and plundering large parts of central and western India. When their raids started extending to British territories as well, he decided to take action against them. For this purpose, the East India Company signed treaties with several native states to ensure their cooperation in this campaign. The major Pindari leaders were appeased by granting them certain territories<sup>3</sup> and the rest of the Pindaris were successfully scattered and pursued by British troops. Some native states, notably the Maratha rulers of Poona, Nagpur and Indore chose this opportunity to start military action against the British. However, the British forces defeated all these rulers. Thus, at the end of 1818, the British emerged as the dominant political power in the subcontinent.

*Policy of “subordinate isolation” (1818-1857):* After 1818, the British followed the policy of “subordinate isolation”. All native states were made politically subordinate to the British and could not establish relations with other states or employ Europeans without explicit British permission. However, they were allowed considerable autonomy in internal matters unless they had specific treaty provisions.<sup>4</sup> During this period, the East India Company continued annexing areas, by means of conquest (Assam, Punjab), cession due to non-payments of debts (Berar), misrule by the native ruler (Coorg, Oudh) and on the death of native rulers without natural heirs (Nagpur, Jhansi, Satara, Sambalpur). The most ambitious Governor-General in this period was Lord Dalhousie (1848-56), who annexed seven major native states (and several smaller ones). Four of these annexation were by

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<sup>3</sup>The native states of Tonk and Jaora were created for this purpose.

<sup>4</sup>For instance, the treaty with Oudh specified that the ruler’s policies “shall be conducive to the prosperity of his subjects, and be calculated to secure the lives and property of the inhabitants”.



the controversial policy of “lapse”, whereby the British Government refused to recognize adoptions by native rulers and annexed native states whose rulers died without a natural heir.

Table 1 shows the impact of certain administrators very clearly: Wellesley’s policy of subsidiary alliances shows up in the high number of annexations in the “ceded” category in 1792-1805, while Lord Dalhousie’s acquisitiveness is seen in the period 1848-56.

In 1857, Indian soldiers in the British army mutinied against their officers. The causes of this “Sepoy Mutiny” are not very clear, and historians disagree as to whether it was a planned war of independence against the British power, or whether it was a uncoordinated uprising of soldiers who felt a threat to their religion and traditional practices (Spear 2002), or whether it was simply a mutiny by soldiers who wanted increased pay and greater career opportunities (David 2002). From the initial uprising in Meerut, the revolt rapidly spread to a number of places in northern and central India, including Delhi, Lucknow, Kanpur and Gwalior. After some initial reverses, the British rallied and, with the help of reinforcements from Punjab and the southern Provinces, were able to suppress the Mutiny by the end of 1858. The policy of the native princes during the revolt was varied: some of them (e.g. Rajgarh) explicitly or covertly helped the mutineers and some rulers of previously annexed states (e.g. Jhansi) became leaders of the revolt, while several others aided the British both by supplying troops and equipment, or by defending the Europeans within their territory (e.g. Gwalior, Patiala). The latter were rewarded for their help and support during the Mutiny, many with grants of territories and some by their annexations being reversed.

*Policy of “union” (1858-1947):* The administration of India was taken over by the British Crown from the East India Company in 1858. The British were of the view that the native states had played an important role in helping them during the revolt, and gave up the policy of annexation. The Queen’s proclamation of 1858 stated specifically that “We desire no extension of our present territorial possessions.” Further, the unpopular policy of annexation by lapse was explicitly abandoned; Lord Canning sent official documents (*sanads*) to several rulers of native states guaranteeing recognition of adopted heirs. However, the British reserved the right to intervene in the internal affairs of native states “to set right such serious abuses in a Native Government as may threaten any part of the country with anarchy or disturbance”.<sup>5</sup> They exercised this right in several native states, often by deposing the ruler and installing another in his place (usually a son, brother or adopted heir) or by appointing a British administrator or council of Regency for

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<sup>5</sup>Lord Canning, Government of India Foreign Department Despatch No. 43A to S/S, 30 April 1860.

some time before allowing the king to take up ruling powers again. Different Viceroys used this power to intervene in different degrees; one of the most vigorous in this regard was Lord Curzon (Viceroy from 1899 to 1905) during whose tenure fifteen rulers were either forced to abdicate or temporarily deprived of their powers (Ashton 1982). Later Viceroys such as Lord Minto reverted to a more non-interventionist policy. During World War I, several native rulers contributed troops and resources to the British war effort. Partly as a result of this, the policy of isolation of native states was finally abandoned and a Council of Princes was constituted in 1921 where they could officially meet and cooperate with each other.

When the British left in 1947, all native states signed treaties of accession to the newly independent nations of India or Pakistan (sometimes helped by military action), and by 1950 they were all integrated into India. The rulers of these states were no longer sovereign rulers, though some of them continued to play an active role in the politics of post-Independence India. The erstwhile rulers were also granted annual incomes or “privy purses” as partial compensation for their loss of state revenue; however this privilege, along with all other princely honors, was discontinued in 1971.

### 3 Data and Empirical strategy

I compare post-Independence outcomes across areas which were formerly part of the British empire and those which were formerly part of native states. I use data at the district level, a district in India being an administrative division below state level. In 1991, India had 415 districts in 17 major states,<sup>6</sup> a district on average having an area of 7500 sq.km. and a population of 1.5 million.

For each modern district, I use old and new maps to find out whether it was a part of the British empire or a native state as of 1947. I assign to each district a “British dummy” which equals one if the district was formerly part of British India. Modern state boundaries are completely different from older native state or British province boundaries, mainly due to the 1956 reorganization of states on a linguistic basis. However, modern district boundaries are more similar to historical boundaries, especially in the British empire areas. Some modern districts comprise several native states, while some native states were large enough to extend over several modern

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<sup>6</sup>The states included in our analysis are Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal.

districts. A few districts contain areas from both the British empire and the native states, in which case the British dummy is assigned to be one if the major part of the district belonged to the British empire.

I compare economic outcomes across these two types of areas in the post-Independence period. In the absence of district-level data on per capita income or net domestic product (these are available only at state level), I focus on other indicators of economic well-being. The major outcomes I consider are measures of agricultural investment and productivity<sup>7</sup> and the availability of public goods. The data for agricultural investments such as the proportion of gross cropped area which is irrigated, fertilizer usage and adoption of high-yielding varieties of cereal come from the India Agriculture and Climate Data Set assembled by the World Bank. These data are all computed at the 1961 district level (some districts have been subdivided into two or more new districts since then). The data for public goods come from the censuses of 1981 and 1991, which list the number of villages in a district having public goods like schools, health centers, roads etc. Data sources are listed in more detail in Appendix Table 2.

I first run ordinary least squares (OLS) regressions of the form:

$$y_i = \alpha + \beta Brit_i + \gamma X_i + \epsilon_i \tag{1}$$

where  $y_i$  is an outcome variable for district  $i$ ,  $Brit_i$  is a dummy for whether the district was part of the British empire in 1947 and  $X_i$  are other district characteristics (mainly geography). Since some native states extended over several districts and the main dependent variable  $Brit_i$  is assigned at the native state level, I compute standard errors clustered at the level of the native state to take into account possible correlation in outcomes across districts that were part of the same native state.<sup>8</sup>

The regression in (1) may not indicate a causal effect of having direct British rule, because the main dependent variable  $Brit_i$  is potentially endogenous. If there are omitted variables which affect the outcomes, and these variables are also correlated with the fact of British annexation, the regression above would give biased estimates. For instance, if it were the case that the British annexed the areas which had the most potential for agricultural productivity, then the OLS regres-

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<sup>7</sup>Agriculture accounted for 37% of India’s total GDP and 67% of the working population in 1981.

<sup>8</sup>For British empire areas, “native states” are assigned according to region and date of annexation: for instance, all areas annexed from Mysore after the 1792 Mysore War are grouped together as belonging to the same “native state” (even though the whole of Mysore was not annexed).

sion would yield an over-estimate of the causal impact of British rule. On the other hand, if it was the case that only the most unproductive areas came under British rule (because local rulers did not put in as much effort to defend these areas and hence they were the easiest to conquer), then the OLS regression provides an underestimate of the impact of British annexation.

To identify the causal impact, I need an exogenous determinant of annexation. For this, I make use of a particular type of annexation policy used by the British: annexation by the “Doctrine of Lapse”, according to which the British would take over a native state if its ruler happened to die without a natural heir. I will argue that this is a plausibly exogenous determinant of whether a district became part of the British empire, and use this as an instrument to estimate the impact of British rule. The details are in section 5.

## 4 OLS comparisons

Areas which were annexed to the British empire have significantly higher rainfall and significantly lower proportion of barren or rocky areas, compared to areas which were part of native states (Table 2). This could indicate that British annexation policy was selective and geared towards picking out the areas which were likely to be more favorable to agriculture. There are no significant differences in other geographical characteristics such as latitude, altitude or major soil types. I will be controlling for geographic variables in all the regressions, however these differences could indicate the presence of other unobserved differences which might bias the OLS estimates.

Table 3 shows that British areas have significantly higher agricultural investments and productivity in the post-Independence period. Each entry in this table represents the coefficient from a regression of the dependent variable (irrigation, fertilizer etc.) on the independent variable (either the British dummy or the dummy interacted with other variables). During the period 1956-87, former British empire areas had a higher proportion of irrigated area, greater fertilizer usage, faster adoption of high-yielding varieties and consequently higher agricultural yields. Further, I see that areas annexed earlier (before 1818) have better performance than areas annexed later: this could be either because a longer period of British rule is more beneficial (causal impact of British rule) or because the British annexed the best areas first (endogeneity). Breaking out the results by mode of annexation employed favors the selective annexation story: areas which were annexed either through cession, misrule or conquest do better than areas annexed due to “lapse” or death of a native ruler without an heir. The results are also positive and strongly significant when I use the

number of years under direct British rule as the main independent variable, rather than a dummy for British rule. Using the number of years under direct British control also enables us to make the right adjustment for some native states that were under British rule for varying periods of time.

Turning to public goods availability in 1981 and 1991 (Table 4), I find that British areas have slightly lower levels of infrastructure at the village level, such as schools, health centers, canals and roads; however the differences are generally not statistically significant. Areas annexed by means other than conquest have significantly lower levels of most of these infrastructure variables.

## 5 Estimating the impact of colonial rule

### 5.1 The Doctrine of Lapse

Lord Dalhousie (1848-1856) stated his policy of “lapse” as follows: “I hold that on all occasions where heirs natural shall fail, the territory should be made to lapse and adoption should not be permitted, excepting in those cases in which some strong political reason may render it expedient to depart from this general rule.” He used this policy to annex several states where Indian rulers died without a natural heir. Table 5 documents instances of rulers dying without natural heirs during the tenure of several Governor-Generals: we see that it was by no means an uncommon occurrence. Eight native states (comprising 20 districts) had rulers die without a natural heir during the Governorship of Lord Dalhousie. Of these, four native states (comprising 16 districts) were successfully annexed.<sup>9</sup> Of the remaining 65 native states (161 districts) where such a death did not occur, Lord Dalhousie annexed only three (18 districts).<sup>10</sup> The policy of lapse thus meant that areas where the ruler died without a natural heir had a higher probability of being annexed.

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<sup>9</sup>The other four were not annexed due to various reasons. Ajaigarh was annexed by Dalhousie but the annexation was reversed by his successor Lord Canning. In Chhatarpur, a nephew of the king was allowed to succeed. Lord Dalhousie recommended annexation in Karauli, but it was disallowed by the East India Company’s Court of Directors. Orchha was considered to be special because it did not pay any tribute to the British; the British also had a prior agreement which allowed the queen to adopt an heir. The historical details are presented in Appendix Table 3.

<sup>10</sup>These were Punjab, Berar and Oudh, which were annexed because of conquest, non-payment of debt and misrule respectively. These areas are also assigned  $Lapse = 0$  because the rulers of Berar and Oudh already had natural heirs in 1848 and the ruler of Punjab lived for forty years after his state was annexed (he was only ten years old at the time of annexation). Lord Dalhousie also annexed the small states of Jaitpur, Udaipur and Baghat, of which the latter two annexations were reversed by Lord Canning.

This can also be seen in the regressions reported in Table 6, where I run the following specification:

$$Brit_i = \pi_0 + \pi_1 Lapse_i + \pi_2 X_i + u_i \quad (2)$$

where  $Lapse_i$  is a dummy which equals one if the ruler died without an heir in the period 1848-1856 and  $X_i$  are other control variables (mainly geography).

Since the policy of lapse was irrelevant for places which had already been annexed before Lord Dalhousie came to India,<sup>11</sup> the sample for these regressions consists of places which had not been annexed in or before 1847 (the “post-1847 sample”). The sample thus consists of those native states which were never annexed ( $Brit = 0, Lapse = 0$  or  $1$ ), those which were annexed due to lapse after 1847 ( $Brit = 1, Lapse = 1$ ) and those which were annexed after 1847 by other means ( $Brit = 1, Lapse = 0$ ). Table 6 shows that the  $Lapse$  dummy is a statistically significant predictor of the  $Brit$  dummy, while geographic variables do not predict British annexation. Further, annexation is predicted by the interaction of two events: the ruler dying in 1848-56 and the ruler dying without an heir and not by either of these separately (column (4)). As expected,  $Lapse$  predicts British annexation even better if we drop the native states annexed for other reasons (column (5)).

Lord Dalhousie’s policy was in contrast to the policies followed by several earlier British administrators who recognized adoptions by native rulers. For instance in the period 1835-1847 (immediately before Dalhousie), fifteen rulers died without natural heirs but only one of these states was annexed. After the revolt of 1857, the British Crown took over the administration in 1858 and official documents guaranteeing British recognition of adopted heirs were sent out to native rulers to reassure them against any future doctrines of lapse. This lends greater validity to our identifying assumption that  $Lapse$  provides an exogenous determinant of British annexation, since the death of a ruler without a natural heir in the specific period of 1848-56 is likely to be a matter of circumstance, rather than caused by systematic factors which might also affect long-term outcomes. Even if there was some selectivity to British annexation among places where such a death occurred, using  $Lapse$  as an instrument for  $Brit$  would yield consistent estimates as long as  $Lapse$  itself does not have a direct impact on outcomes.

## 5.2 Instrumental variable estimates

Table 7 computes instrumental variable estimates of the impact of British rule on agricultural investments and productivity. Columns (2) and (3) show OLS results for the full sample and for

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<sup>11</sup>Only one district (Jalaun) in our sample had been annexed because of lapse before Lord Dalhousie.

the post-1847 sample respectively. The OLS estimates are smaller in the post-1847 sample, where exogenous variation induced by the policy of lapse is an important determinant of British empire status. The reduced form results in column (4) and IV results in column (5) confirm what column (2) indicates: once selection in British annexation is controlled for, British areas do not show significantly better performance than native state areas. All the IV estimates are smaller than the OLS estimates and statistically insignificant. Further, the coefficients for fertilizer usage, total yield and rice yield are significantly different from the OLS estimates for the full sample. I also run the IV regressions after dropping the areas annexed by Lord Dalhousie for non-lapse reasons: the concern here is that these might be the “best” areas in some sense, since the British went to the trouble of annexing them even when the rulers did not die without natural heirs. As these states have  $Lapse = 0$ , it is worthwhile to verify that the IV results are not being driven by these particular set of states. Note that since we have potentially removed the best places from the  $Lapse = 0$  group, these results are likely to be biased upward.

The difference between the OLS and the IV results suggests that there was a high degree of selectivity in British annexation policy, and that annexation was directed towards acquiring areas with the highest agricultural potential. In view of the fact that land revenue was the biggest source of government revenue throughout the colonial period, it is not surprising that the British chose to acquire the best agricultural areas. This is also consistent with the differences in rainfall and proportion of barren areas observed earlier. The OLS results in Table 3 also support the hypothesis of selective annexation: areas annexed before 1818 typically have better outcomes than areas annexed after 1818, and the latter coefficients are also larger than the OLS coefficients for the post-1847 sample. The positive coefficients obtained using the years of direct British rule also support this conclusion. The mostly insignificant IV estimates in turn imply that British rule had no significant causal impact on long-term agricultural outcomes.

Table 8 shows similar regressions for the availability of public goods: in contrast to the small and mostly insignificant OLS comparisons, the instrumental variable estimates indicate a statistically significant and negative impact of British rule on the availability of middle schools, health centers and roads. Again, the difference between the OLS and IV results indicates a high degree of selectivity in British annexation. The IV estimates imply very large differences in public goods availability: districts which were part of the British empire have 37% fewer villages with middle schools, 70% fewer villages equipped with primary health subcenters, and 46% fewer villages

with access to good roads in 1981 and 1991. The strong negative impact of colonial rule on the availability of public goods indicated by the IV results is also supported by the negative OLS coefficients we obtain on the number of years of direct British rule (column (6) of table 4). If the presence of public goods is significantly correlated with economic growth and incomes, then the fact of having a colonial history might turn out to be a crucial determinant of long-run growth.

The IV results are robust to dropping the areas annexed by Lord Dalhousie for non-lapse reasons (Table 8, column (6)). The results are also robust (regressions not shown) to the addition of soil type dummies : the overall estimate for the combined public goods regression is -0.062 compared to -0.075 in the base specification. The estimates are also negative and significant when I control for population density (overall public goods difference is now -0.057), though population density may be endogenous in this context, since it has the potential of being affected by public health policies.<sup>12</sup>

### 5.3 Other possible effects of ruler death

The validity of the identification strategy used above rests on the assumption that *Lapse* is a legitimate instrument for British rule. This means that *Lapse* must be uncorrelated with the residual error term  $\epsilon$  in equation (1). In other words, if the event of ruler death without natural heir in the period 1848-56 influences long-term outcomes for reasons other than British annexation, then the instrumental variable estimates are no longer consistent. In this section, I consider other possible effects of ruler death on long-term outcomes (Table 9).

First, it is possible that the event of a ruler dying without an heir might reflect some characteristics of the area or of the ruling family, which might also affect long-term outcomes directly. I therefore re-run the regressions of public goods on the *Lapse* dummy after adding dummies for ruler death in 1848-56 (as a proxy for bad conditions in those years) and for the ruler ever dying without heirs in the post-1818 period (as a proxy for a physically weak royal family). The estimates obtained are in fact larger in magnitude than the specification without these controls. Further, these controls are usually insignificant in all the regressions.

Second, I check directly whether ruler death without natural heirs has any impact on public goods availability without British annexation. As mentioned earlier, the policy of lapse was officially given up after 1858. I regress public goods outcomes on a dummy which equals one if the ruler

<sup>12</sup>This is especially true in the colonial period when the major cause of death was from epidemics and famines.



died without a natural heir in the period 1858-1884 during which such a death would not result in British annexation.<sup>13</sup> The estimates using this dummy are much lower in magnitude than the results using the *Lapse* dummy, and they are also statistically insignificant. This supports the hypothesis that the impact of *Lapse* is only through British annexation.

Third, the standard errors might be incorrect due to small sample bias. As mentioned earlier, I correct for possible correlation of errors within districts of the same native states by using the method of clustering, but the consistency of these standard errors requires a large sample. To account for this, I compute exact finite-sample  $p$ -values for the estimates using the method of “randomization inference”.<sup>14</sup> This consists of re-assigning the *Lapse* dummy randomly, computing the reduced form estimator and simulating the finite sample distribution of our estimator. The implied standard errors are larger than the ones obtained by clustering but our overall estimate is still significant with a  $p$ -value of 0.05.

Fourth, the instrument may be called into question if the British deliberately caused the death of certain rulers. The historical evidence however does not indicate any such moves on their part, neither were they ever accused of this even by the royal families affected by the doctrine of lapse. A related issue is the question of whether some native states established “fake” natural heirs to avoid being taken over by lapse. There is no historical information on whether such a strategy was followed by some rulers, neither are there any accounts of the validity of natural heirs being investigated by the British.

These robustness checks support the conclusion that British rule had a significant negative impact on the availability of public goods in the post-Independence period. The next section discusses why this might happen, and provides some additional evidence.

## 6 Interpretation of results and additional evidence

### 6.1 Why do British areas have lower public goods?

The instrumental variables results above indicate that former British empire areas have lower levels of public goods in the post-Independence period. It is possible that these differences represent differences which arose in the colonial period itself and which have not been eradicated in the post-Independence period. Colonial-period differences might arise for several reasons: native princes

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<sup>13</sup>This happened in ten native states.

<sup>14</sup>See Bertrand, Duflo and Mullainathan (2001) for details.

might have a greater commitment to provide public goods for their people (because they would rule for their whole life and could bequeath the state to their descendants), or they could implement policies better due to superior local knowledge, or they could have been motivated by the fear of being deposed by the British if they did not rule well. Alternatively, it could be that the British followed very extractive policies in the areas under their direct control, or that native states had certain institutions which enabled them to provide better public goods. If this is the case, then we might expect to see the differences between British empire and native state areas to be narrowing over time.

Another possibility is that the observed differences arise in the post-Independence period. This could be because former native state areas have a superior ability to obtain or utilize resources in the post-Independence period (perhaps due to the presence of a prominent local leader). In the following section, I use (limited) data from earlier periods to shed some light on these issues.

## 6.2 Some additional evidence

Anecdotal evidence suggests that at least some native states were greatly committed to investments in education and health during the colonial period. For instance, the native state of Mysore carried out smallpox vaccination as early as 1806. The state of Travancore announced a policy of free primary education in 1817, whereas the East India Company decided to give assistance “to the more extended and systematic promotion of general education in India” only after the influential Dispatch written by Sir Charles Wood in 1854. The state of Baroda was probably the first to introduce compulsory primary education in 1892, while the British passed a compulsory education act in the nearby Central Provinces only in 1920. Roy (2002) also notes that “the British government did not build an effective mass education system”.

Data from earlier periods also seems to indicate that the differences in public goods arose in the colonial period. Table 10 reports regression results using public goods data from 1961. The IV estimates indicate that British empire areas had lower levels of primary schools, middle schools and medical dispensaries in 1961 itself, though as before the OLS results do not indicate any significant differences.<sup>15</sup> Though the estimated differences for middle and high schools are lower in magnitude than the differences in Table 9, they are larger as a proportion of the mean level in 1961. It is also interesting to note that there are large differences in the availability of primary schools, which are

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<sup>15</sup>The data on rural health centers, canals and roads are missing for several states in this year.

not present in the later period data. These results indicate that the differences we observe probably arose in the colonial period itself, and that the differences are growing smaller over time, especially differences in the availability of schools. There does not seem to be any noticeable time path in the agricultural outcomes: the OLS and IV results for 1956 (the first year for which I have data) are not statistically different from the overall results, except for fertilizer usage where the difference is insignificant in the early periods but becomes larger in the later periods (regressions not shown).

Going back in time, province-level data from 1901 (Table 11, Panel A) shows that the highest literacy rates in that period were in the native states of Travancore and Baroda. Panel B shows that the areas under native rule in the present states of Gujarat, Kerala and Madhya Pradesh had somewhat higher levels of literacy in the Colonial period, while there is hardly any difference in the post-Independence period.<sup>16</sup> This also suggests that British empire areas might be catching up in the post-Independence period. Panel C presents some data on infant mortality rates in districts of Madhya Pradesh: again, the gap between British empire areas and native states seems to be narrower in the later periods.<sup>17</sup> These data are more indicative than conclusive, because the small sample size prevents us from running regressions controlling for geography.<sup>18</sup>

The observed differences cannot be attributed wholly to excessive extraction by the British during the colonial period: revenue figures from the 1890's indicate that the native states raised 3.42 rupees per capita in revenue, while the corresponding figure for British India was only 2.47 rupees. It is also unlikely that the results are due to differences in some specific institution across British India and the native states. As mentioned before, the native states varied considerably with regard to institutions like land revenue systems, legal systems and administrative setup. A preliminary check of this is also provided by adding a dummy for a landlord-dominated land revenue system in addition to the British dummy:<sup>19</sup> this is completely insignificant and does not change the

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<sup>16</sup>Choice of these states is dictated by the availability of district-level Gazetteers which contain some historical data, as also by the fact that these three states contained both British empire and native state areas. In particular, Madhya Pradesh contains some districts annexed by lapse.

<sup>17</sup>It is a little puzzling that the infant mortality rates are increasing over 1965, 1970 and 1981.

<sup>18</sup>Regressions for infant mortality in 1981 and 1991 (where we have data for all the states) show the same pattern as for public goods: British districts are not significantly different from native states in OLS regressions, but have significantly higher infant mortality in the IV regressions.

<sup>19</sup>The land revenue system was probably the single most important institution in the colonial period since land revenue was the biggest source of revenue, both for British India and for the native states. See Banerjee and Iyer (2002) for evidence that historical land revenue systems caused persistent differences in outcomes within British India.

main IV coefficients.<sup>20</sup> It is also not the case that the areas annexed by lapse were administered in a different manner: they were usually added to existing British provinces and brought under the prevailing administrative systems in those provinces.<sup>21</sup> It seems more likely that the differences are due to differences in the incentives of the administrators: native princes seem to have made a greater effort to provide public goods for their subjects, either because they were more committed to the local area, or because they had a fear of being deposed. However, I cannot distinguish among these different alternatives with the data at hand.

## 7 Conclusion

In this paper, I compare long-run outcomes of areas in India which were under direct British colonial rule with areas which were ruled indirectly, using an exogenous source of variation to control for selection of states into the British empire. The instrumental variable results indicate that the British selectively annexed areas based on agricultural potential, and that British-ruled areas lag behind in the availability of public goods in the post-Independence period. This difference is mainly due to differences existing in the colonial period itself, and appears to be narrowing over time. Given that foreign and defence policy were controlled by the British in the colonial period, and that the results cannot be wholly attributed to excessive extraction by the British or to differences in specific institutions, these differences are probably due to differences in the incentives faced by the administrators in the two types of areas. The policy implications of the results differ depending on the motives we ascribe to native rulers. For instance, if it is the case that native rulers were able to pursue better policies because of their superior local knowledge or because they felt a greater commitment to the progress of their area, policies aimed at increasing decentralization or grass-roots democracy (like the village-level Panchayati Raj system in India) would be expected to result in better public goods provision. If native rulers had a longer horizon than administrators in British areas (because they did not have any term limits or could bequeath the state to their descendants), then the policy implications call for developing long-term relationships between policy-makers or administrators and the people. Alternatively, if the fear of being deposed was the major reason for

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<sup>20</sup>The regression needs to be interpreted with caution since we do not have data on the systems pursued in all native states. Also the adoption of a particular institution by a native ruler might be correlated with other dimensions of policy.

<sup>21</sup>In particular it meant that the states annexed by lapse ended up with different land revenue systems: Nagpur was under a landlord-dominated land revenue system, while Satara, Sambalpur and Jhansi were not.

better performance, the policy implication would be to provide for better monitoring and greater punishments for policy-makers and administrators.

While there is some evidence that the gap between British and native areas is narrowing over time, it is interesting that we observe significant differences for as long as forty years after the end of colonial rule. This implies that the effect of a history of colonialism can last for a very long time, though it may eventually disappear.

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**TABLE 1**  
**GROWTH OF THE BRITISH EMPIRE IN INDIA**

Period	Number of districts annexed due to				Total
	Conquest	Ceded or granted	Misrule	Lapse	
1757-1790	60	19	0	0	79
1791-1805	46	37	1	0	84
1806-1818	29	0	0	0	29
1819-1835	20	0	1	0	21
1836-1847	19	0	1	1	21
1848-1856	2	4	12	16	34
1857-1947	0	1	0	0	1
Total	176	61	15	17	269

Notes:

Number of districts refers to 1991 districts. The total number of districts is 415, of which 269 were classified as belonging to British India.

The states of Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura are excluded from the study.

Number of districts in subsequent regressions will be less than 415, due to missing data and because some districts were split into two or more new districts over time, and some datasets use older un-split districts.



**TABLE 2**  
**DIFFERENCES IN GEOGRAPHY AND DEMOGRAPHICS**

Variable	# districts	# native states	Mean		Difference (s.e.)
			British empire	Native states	
<b>Geography</b>					
Latitude (degrees North)	407	98	23.29	22.79	0.509 (1.813)
Altitude (metres above sea level)	359	92	392.63	413.27	-20.64 (58.73)
Mean annual rainfall (mm)	414	98	1503.41	1079.16	424.35*** (151.08)
Coastal district (dummy)	415	98	0.1264	0.0822	0.0442 (0.0597)
Proportion sandy	378	96	0.0079	0.0117	-0.0038 (0.0074)
Proportion barren/rocky	378	96	0.0050	0.0121	-0.0070** (0.0028)
<u>Top two soil types</u>					
Black soil (dummy)	362	93	0.1568	0.2937	-0.1369 (0.1075)
Alluvial soil (dummy)	362	93	0.5254	0.4921	0.0334 (0.1301)
Red soil (dummy)	362	93	0.2203	0.0952	0.1251 (0.0776)
<b>Demographic variables</b>					
Log (population)	323	93	14.42	13.83	0.591*** (0.155)
Population density (persons/sq.km)	322	93	279.47	169.20	110.27** (41.66)
Proportion rural	323	93	0.8210	0.8182	0.0028 (0.0154)
Proportion of working population in farming	323	93	0.6961	0.7072	-0.0111 (0.0239)
Proportion Scheduled Caste	323	93	0.1567	0.1512	0.0055 (0.0148)
Proportion Scheduled Tribe	323	93	0.0859	0.0973	-0.0114 (0.0271)
Proportion literate	323	93	0.3234	0.2867	0.0367 (0.0283)

Robust standard errors in parentheses, corrected for clustering within native states.

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Data is at 1991 district level for geographic variables, and 1961 district level for demographic variables.

Demographic data is computed as the mean from the censuses of 1961,1971,1981,1991. Population density figures exclude 1991 data.

Data sources listed in Appendix Table 2.

**TABLE 3**  
**DIFFERENCES IN AGRICULTURAL INVESTMENTS AND PRODUCTIVITY: OLS ESTIMATES**

	Coefficient on								
	British dummy		British dummy interacted with date of annexation		British dummy interacted with mode of annexation				Years of direct British rule (*1/100)
	(1) no controls	(2) Geography controls	(3)		(4)				
		Annexed before 1818	Annexed after 1818	Conquest	Ceded	Misrule	Lapse	(5)	
<u>Dependent variables (1956-87 mean)</u>									
Proportion of area irrigated	0.111*** (0.039)	0.099*** (0.037)	0.104** (0.041)	0.085** (0.042)	0.069 (0.051)	0.152*** (0.043)	0.113** (0.047)	0.062 (0.046)	0.079*** (0.024)
Fertilizer usage (kg/hectare)	8.428** (3.541)	7.014** (3.073)	6.879** (3.315)	7.379 (4.465)	4.943 (4.308)	10.542*** (2.803)	13.731** (5.741)	-1.485 (2.717)	5.563*** (1.910)
Proportion of cereal area sown with high-yielding varieties	0.074** (0.034)	0.066** (0.028)	0.061* (0.032)	0.078** (0.031)	0.046 (0.039)	0.103*** (0.033)	0.073** (0.035)	0.041* (0.022)	0.053*** (0.019)
Log total yield (15 major crops)	0.381*** (0.121)	0.213*** (0.080)	0.245*** (0.087)	0.128 (0.110)	0.210** (0.103)	0.236** (0.112)	0.282*** (0.077)	0.076 (0.092)	0.194*** (0.051)
Log rice yield	0.135 (0.112)	0.151* (0.083)	0.174** (0.085)	0.090 (0.107)	0.220** (0.106)	0.106 (0.096)	0.128* (0.077)	-0.023 (0.090)	0.135** (0.056)
Log wheat yield	-0.002 (0.170)	-0.064 (0.088)	-0.046 (0.089)	-0.109 (0.119)	-0.017 (0.091)	-0.076 (0.104)	-0.133* (0.072)	-0.185 (0.204)	-0.006 (0.057)
<u>Controls</u>									
Latitude, rainfall, coast	no	yes	yes			yes			yes
Proportion sandy/barren	no	yes	yes			yes			yes
Soil type dummies	no	yes	yes			yes			yes
# districts	271	271	271			271			271
# native states	83	83	83			83			83

Robust standard errors in parentheses, corrected for clustering within native states. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%  
Each cell represents the coefficient from an OLS regression of the dependent variable on the independent variable, which is a dummy for direct British rule in (1) and (2), the dummy interacted with other variables in (3) and (4) and number of years of direct British rule in (5).

Data is missing for the states of Kerala, Assam, Jammu & Kashmir and Himachal Pradesh. All data are at 1961 district level.

**TABLE 4**  
**DIFFERENCES IN PUBLIC GOODS LEVELS : OLS ESTIMATES**

	Coefficient on									
	British dummy			British dummy interacted with date of annexation		British dummy interacted with mode of annexation				Years of direct British rule (*1/100)
	(1) no controls	(2) Geography controls	(3) Geography + soil controls	(4)		(5)				(6)
			Annexed before 1818	Annexed after 1818	Conquest	Ceded	Lapse	Misrule		
<u>Dependent variables: Proportion of villages having public goods</u>										
(mean of 1981 and 1991 data)										
Primary school	-0.035 (0.039)	-0.016 (0.032)	-0.007 (0.032)	-0.032 (0.038)	0.029 (0.036)	0.035 (0.037)	-0.121*** (0.042)	-0.062** (0.028)	-0.007 (0.029)	-0.027 (0.022)
Middle school	-0.035 (0.046)	-0.046 (0.034)	-0.033 (0.035)	-0.049 (0.039)	-0.037 (0.039)	-0.008 (0.043)	-0.106*** (0.038)	-0.077*** (0.027)	-0.085*** (0.031)	-0.050** (0.023)
High school	-0.045 (0.049)	-0.068* (0.040)	-0.059 (0.038)	-0.074* (0.044)	-0.050 (0.040)	-0.041 (0.045)	-0.112*** (0.043)	-0.096*** (0.034)	-0.081** (0.037)	-0.061** (0.026)
Primary health center	-0.010 (0.017)	-0.024* (0.014)	-0.019 (0.013)	-0.025 (0.016)	-0.020 (0.014)	-0.018 (0.016)	-0.036** (0.017)	-0.023* (0.013)	-0.029** (0.012)	-0.022** (0.010)
Primary health subcenter	0.006 (0.017)	-0.002 (0.017)	0.005 (0.017)	0.004 (0.020)	-0.015 (0.015)	0.017 (0.021)	-0.033* (0.018)	0.005 (0.013)	-0.037** (0.015)	-0.002 (0.012)
Canals	-0.028 (0.021)	-0.010 (0.014)	-0.011 (0.014)	-0.006 (0.014)	-0.021 (0.015)	-0.001 (0.016)	-0.021 (0.014)	-0.029** (0.013)	-0.022* (0.013)	-0.005 (0.010)
Roads	0.028 (0.072)	0.043 (0.065)	0.077 (0.064)	0.032 (0.079)	0.075 (0.087)	0.066 (0.095)	0.033 (0.051)	0.097* (0.055)	-0.113** (0.044)	-0.007 (0.053)
Combined public goods	-0.017 (0.029)	-0.017 (0.025)	-0.006 (0.025)	-0.021 (0.029)	-0.005 (0.028)	0.008 (0.033)	-0.057** (0.023)	-0.026 (0.018)	-0.055*** (0.018)	-0.024 (0.017)
<u>Controls</u>										
Latitude, rainfall, coast	no	yes	yes	yes			yes			yes
Proportion sandy/barren	no	yes	yes	yes			yes			yes
Soil type dummies	no	no	yes	no			no			no
# districts	404	377	340	377			377			377
# native states	97	96	92	96			96			96

Robust standard errors in parentheses, corrected for clustering within native states. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Each cell represents the coefficient from an OLS regression of the dependent variable on the independent variable, which is a dummy for British rule in (1)-(3), the dummy interacted with other variables in (4)-(5) and number of years of direct British rule in (6).

Data is missing for middle schools in Gujarat, high schools in Madhya Pradesh and primary health subcenters in Karnataka.

Data is missing for Assam in 1981 and Jammu & Kashmir in 1991.

**TABLE 5**  
**DEATHS OF INDIAN RULERS WITHOUT NATURAL HEIRS**

Period	Governor-General (s)	Ruler died without an heir		Annexed due to lapse		Annexed due to other reasons	
		#native states	#districts	#native states	#districts	#native states	#districts
1819-1827	Hastings, Amherst	5	14	0	0	3	17
1828-1835	Bentinck, Metcalfe	6	9	0	0	2	4
1836-1847	Auckland, Ellenborough, Hardinge	15	31	1	1	4	19
<b>1848-1856</b>	<b>Dalhousie</b>	<b>8</b>	<b>20</b>	<b>4</b>	<b>16</b>	<b>3</b>	<b>18</b>
1857-1863	Canning, Elgin	6	10	0	0	1	1
1864-1875	Lawrence, Mayo, Northbrook	7	20	0	0	0	0
1876-1884	Lytton, Ripon	3	5	0	0	0	0

**TABLE 6**  
**FIRST STAGE OF IV STRATEGY**

**Dependent variable: British dummy**

	Post-1847 sample				
	no controls (1)	geography (2)	soils (3)	main effects (4)	Exclude Punjab, Berar, Oudh (5)
Ruler died without natural heir in 1848-1856 (Instrument)	0.682*** (0.159)	0.673*** (0.155)	0.669*** (0.162)	0.953*** (0.176)	0.771*** (0.140)
<u>Main effects</u>					
Ruler died without heir				-0.231* (0.126)	0.027 (0.021)
Ruler died in 1848-56				-0.161 (0.101)	0.013 (0.023)
<u>Geography controls</u>					
Latitude		0.012 (0.011)	0.016 (0.011)	0.015 (0.012)	-0.002 (0.002)
Mean annual rainfall		0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
Coastal dummy		-0.120 (0.082)	-0.096 (0.100)	-0.067 (0.089)	-0.016 (0.024)
Proportion sandy		-0.289 (0.242)	-0.119 (0.241)	-0.085 (0.113)	-0.033 (0.061)
Proportion barren/rocky		-2.791 (1.773)	-2.744 (1.774)	-2.188 (1.839)	-1.279 (1.171)
Altitude (*1/1000)			-0.000 (0.000)		
Black soil dummy			0.091 (0.091)		
Alluvial soil dummy			0.027 (0.085)		
Red soil dummy			-0.030 (0.071)		
No. of districts	181	163	152	163	145
No. of native states	73	71	67	71	68
R-squared	0.29	0.35	0.37	0.42	0.73

Robust standard errors in parentheses, corrected for clustering within native states.

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Post-1847 sample refers to areas which were not annexed in or before 1847.

All results are from linear regressions.

Main effect "Ruler died without heir" is a dummy which equals one if the native state had a ruler die without an heir at any time after 1818.

Main effect "Ruler died in 1848-56" is a dummy which equals one if the ruler of the native state died in the period 1848-1856.

**TABLE 7**  
**DIFFERENCES IN AGRICULTURAL INVESTMENTS AND PRODUCTIVITY: IV ESTIMATES**

	Mean of dep. var.	Coefficient on				
		British dummy Full sample	British dummy Post-1847 sample	Lapse dummy Post-1847 sample	British dummy Post-1847 sample	British dummy Post-1847 sample (excluding Punjab, Oudh, Berar)
		OLS (1)	OLS (2)	Reduced form (3)	IV (4)	IV (5)
<u>Dependent variables (1956-87 mean)</u>						
Proportion of area irrigated	0.228	0.099*** (0.037)	0.063 (0.046)	0.037 (0.039)	0.029 (0.064)	0.032 (0.053)
Fertilizer usage (kg/hectare)	20.04	7.014** (3.073)	3.770 (4.251)	-1.948 (2.323)	-6.176* (3.671)	-4.311 (2.790)
Proportion of cereal area sown with high-yielding varieties	0.330	0.066** (0.028)	0.083** (0.037)	0.031 (0.028)	0.028 (0.037)	0.046 (0.032)
Log total yield (15 major crops)	-0.161	0.213*** (0.080)	0.117 (0.119)	0.054 (0.079)	0.019 (0.126)	0.023 (0.106)
Log rice yield	-0.077	0.151* (0.083)	0.046 (0.120)	-0.064 (0.120)	-0.171 (0.206)	-0.136 (0.158)
Log wheat yield	-0.114	-0.064 (0.088)	-0.089 (0.113)	-0.114 (0.160)	-0.190 (0.244)	-0.172 (0.220)
<u>Controls</u>						
Latitude, rainfall, coast		yes	yes	yes	yes	yes
Proportion sandy/barren		yes	yes	yes	yes	yes
Soil type dummies		yes	yes	yes	yes	yes
# districts		271	136	136	136	118
# native states		83	58	58	58	55

Robust standard errors in parentheses, corrected for clustering within native states.

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

IV estimates computed using the *Lapse* dummy as an instrument for British rule. *Lapse* = 1 if ruler died without a natural heir in the period 1848 to 1856  
 Post-1847 sample refers to areas which were not annexed in or before 1847.

Data is missing for the states of Kerala, Assam, Jammu & Kashmir and Himachal Pradesh. All data are at 1961 district level.

**TABLE 8**  
**DIFFERENCES IN PUBLIC GOODS LEVELS : IV ESTIMATES**

	Mean of dep. var.	Coefficient on				
		British dummy Full sample	British dummy Post-1847 sample	Lapse dummy Post-1847 sample	British dummy Post-1847 sample	British dummy Post-1847 sample (excluding Punjab, Oudh, Berar)
		OLS (1)	OLS (2)	Reduced form (3)	IV (4)	IV (5)
<u>Dependent variables: Proportion of villages having public goods</u>						
(mean of 1981 and 1991 data)						
Primary school	0.7720	-0.016 (0.032)	-0.007 (0.039)	-0.007 (0.028)	-0.011 (0.041)	-0.012 (0.036)
Middle school	0.2485	-0.046 (0.034)	-0.047 (0.031)	-0.061** (0.025)	-0.091** (0.037)	-0.083** (0.032)
High school	0.1260	-0.068* (0.040)	-0.061* (0.033)	-0.049 (0.032)	-0.065 (0.042)	-0.064* (0.037)
Primary health center	0.0415	-0.024* (0.014)	-0.015* (0.008)	-0.021*** (0.008)	-0.031** (0.013)	-0.028** (0.011)
Primary health subcenter	0.0753	-0.002 (0.017)	-0.007 (0.017)	-0.036*** (0.011)	-0.053** (0.021)	-0.043*** (0.016)
Canals	0.0477	-0.010 (0.014)	-0.024* (0.014)	-0.029** (0.015)	-0.043 (0.028)	-0.041* (0.024)
Roads	0.4344	0.043 (0.065)	-0.010 (0.067)	-0.134*** (0.032)	-0.198*** (0.066)	-0.157*** (0.050)
Combined public goods	0.2535	-0.017 (0.025)	-0.026 (0.021)	-0.051*** (0.012)	-0.075*** (0.023)	-0.065*** (0.019)
<u>Controls</u>						
Latitude, rainfall, coast		yes	yes	yes	yes	yes
Proportion sandy/barren		yes	yes	yes	yes	yes
# districts		377	163	163	163	145
# native states		96	71	71	71	68

Robust standard errors in parentheses, corrected for clustering within native states. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%  
IV estimates computed using the *Lapse* dummy as an instrument for British rule. *Lapse* =1 if ruler died without a natural heir in the period 1848 to 1856.  
Post-1847 sample refers to areas which were not annexed in or before 1847.

Data is missing for middle schools in Gujarat, high schools in Madhya Pradesh and primary health subcenters in Karnataka.

Data is missing for Assam in 1981 and Jammu & Kashmir in 1991.

**TABLE 9**  
**REDUCED FORM REGRESSIONS FOR PUBLIC GOODS: ROBUSTNESS CHECKS**

	Coefficient on			
	Lapse dummy Reduced form Post-1847 sample Base specification (1)	Lapse dummy Reduced form Post-1847 sample With "main effects" (2)	Fake instrument Reduced form Native states sample Falsification test (3)	Lapse dummy Reduced form Post-1847 sample Exact <i>p</i> -values (4)
<u>Dependent variables: Proportion of villages having public goods</u> (mean of 1981 and 1991 data)				
Primary school	-0.007 (0.028)	-0.032 (0.050)	-0.094** (0.039)	-0.007 [0.48]
Middle school	-0.061** (0.025)	-0.100* (0.052)	0.006 (0.034)	-0.061 [0.14]
High school	-0.049 (0.032)	-0.048 (0.059)	-0.067 (0.047)	-0.049 [0.24]
Primary health center	-0.021*** (0.008)	-0.015 (0.020)	-0.012 (0.016)	-0.021 [0.14]
Primary health subcenter	-0.036*** (0.011)	-0.062** (0.025)	-0.011 (0.016)	-0.036 [0.05]
Canals	-0.029** (0.015)	-0.128** (0.050)	0.017 (0.041)	-0.029 [0.11]
Roads	-0.134*** (0.032)	-0.142* (0.083)	-0.023 (0.050)	-0.134 [0.06]
Combined public goods	-0.051*** (0.012)	-0.079** (0.030)	-0.023 (0.022)	-0.051 [0.05]
<u>Controls</u>				
Latitude, rainfall, coast	yes	yes	yes	yes
Proportion sandy/barren	yes	yes	yes	yes
Ruler died in 1848-1856	no	yes	no	no
Ruler died without heir	no	yes	no	no
# districts	163		128	163
# native states	71		63	71

Robust standard errors in parentheses, corrected for clustering within native states.

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Post-1847 sample refers to areas which were not annexed in or before 1847.

Lapse dummy equals one if ruler died without a natural heir in the period 1848 to 1856.

Main effect "Ruler died without heir" is a dummy which equals one if the native state had a ruler die without an heir at any time after 1818.

Main effect "Ruler died in 1848-56" is a dummy which equals one if the ruler of the native state died in the period 1848-1856.

"Fake instrument" is a dummy for whether the ruler died without an heir in the period 1858-1884.

Column (4) shows *p*-values [in square brackets] constructed by the randomization inference procedure, to adjust for possible small-sample bias in clustering. See Bertrand et.al. (2001) for details.

Data is missing for middle schools in Gujarat, high schools in Madhya Pradesh and primary health subcenters in Karnataka. Data is missing for Assam in 1981 and Jammu & Kashmir in 1991.



**TABLE 10**  
**DIFFERENCES IN PUBLIC GOODS LEVELS IN 1961**

	Mean of dep. var.	No. of districts (no. of native states)	Coefficient on		
			British dummy OLS Full sample	British dummy IV Post-1847 sample	British dummy IV Post-1847 sample Excluding Punjab, Oudh, Berar
<u>Dependent variables: Proportion of villages having public goods</u>					
(1961 data)					
Primary school	0.5126	234 (81)	0.024 (0.041)	-0.127* (0.067)	-0.106* (0.062)
Middle school	0.0972	219 (78)	-0.040 (0.035)	-0.068* (0.035)	-0.058* (0.030)
High school	0.0303	286 (88)	-0.032 (0.020)	-0.037 (0.022)	-0.031* (0.018)
Dispensaries	0.0733	234 (81)	-0.075* (0.043)	-0.069* (0.039)	-0.062* (0.036)
Rural health center	0.0244	159 (54)	-0.007 (0.010)	-0.007 (0.008)	-0.005 (0.007)
Canals	0.0017	134 (49)	0.003 (0.003)	-0.000 (0.000)	-0.000 (0.000)
Roads	0.2124	234 (68)	0.052 (0.055)	-0.077 (0.092)	-0.047 (0.069)
<u>Controls</u>					
Latitude, rainfall, coast			yes	yes	yes
Proportion sandy/barren			yes	yes	yes

Robust standard errors in parentheses, corrected for clustering within native states.

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Post-1847 sample refers to areas which were not annexed in or before 1847.

Instrument is a dummy for whether the ruler died without an heir in the period 1848-1856.

Data on rural health centers and canals is missing for UP, Tamil Nadu, Rajasthan, Orissa and Maharashtra.

Data on primary schools, middle schools and dispensaries is missing for Uttar Pradesh.

Data on middle schools, canals and roads is missing for West Bengal.

Data on roads is missing for Punjab and Rajasthan.

**TABLE 11**  
**EDUCATION AND HEALTH OUTCOMES: DATA FROM EARLIER PERIODS**

**Panel A : Province-level literacy rates 1901**

Province/ Region	Literacy rates (%)	
	Male	Female
<u>Native States</u>		
Travancore	21.5	3.1
Baroda	16.3	0.8
Mysore	9.3	0.8
Rajputana	6.2	0.2
Central India	5.5	0.3
Hyderabad	5.5	0.3
Kashmir	3.8	0.1
<u>British Empire</u>		
Madras	11.9	0.9
Bombay	11.6	0.9
Bengal	10.4	0.5
Berar	8.5	0.3
Assam	6.7	0.4
Punjab	6.4	0.3
United Provinces	5.7	0.2
Central Provinces	5.4	0.2

Source: Hunter et.al. (1908)

**Panel B : District-level literacy rates (Gujarat, Kerala, Madhya Pradesh)**

Years	British empire	Native states	Difference
1921, 1931, 1941	7.16	10.01	-2.67 (1.50)
1951, 1961, 1971	26.09	24.52	0.95 (2.10)

Standard errors in parantheses, correcting for year fixed effects.  
 Data are from District gazetteers of Gujarat, Kerala and Madhya Pradesh states.  
 Data available for 12, 14 and 10 districts for 1921, 1931 and 1941 respectively.  
 Data available for 52 districts in 1951 and 74 districts in 1961 and 1971.

**Panel C : Infant mortality rates (Madhya Pradesh districts)**

Year	British empire	Native states	Difference
1965	114.01	60.96	53.05 (19.89)
1970	122.98	67.91	55.07 (5.73)
1981	157.38	146.66	10.71 (6.55)
1991	126.06	115.72	10.34 (5.48)

Standard errors in parantheses, corrected for clustering within native states.  
 Data for 1965 and 1970 are from District gazetteers of Gujarat and Madhya Pradesh states.  
 Data available for 21 districts in 1965, 22 in 1970 and 45 in 1981 and 1991, corresponding to 11, 12 and 17 native states respectively. Differences do not control for any covariates.

**APPENDIX TABLE 1: MAJOR NATIVE STATES IN 1947**

Native state	No. of guns in salute	Date of treaty with British	Area (sq.miles)	Population (1896)	Religion of ruler	No. of modern districts
Baroda	21	1802	8570	2185005	Hindu	3
Gwalior	21	1781	29046	3115857	Hindu	9
Hyderabad	21	1759	98000	9845594	Muslim	20
Kashmir	21	1846	80000	1534972	Hindu	14
Mysore	21	1799	24723	4186188	Hindu	10
Bhopal	19	1817	6873	954901	Muslim	3
Indore	19	1805	8400	1054237	Hindu	3
Kolhapur	19	1766	2816	800189	Hindu	1
Travancore	19	1723	6730	2401158	Hindu	6
Udaipur	19	1818	12670	1494220	Hindu	3
Bharatpur	17	1803	1974	645540	Hindu	1
Bikaner	17	1818	22340	509021	Hindu	3
Bundi	17	1818	2300	254701	Hindu	1
Cochin	17	1791	1361	600278	Hindu	3
Jaipur	17	1818	14465	2534357	Hindu	3
Jodhpur	17	1818	37000	1750403	Hindu	5
Karauli	17	1817	1208	148670	Hindu	1
Kota	17	1817	3797	517275	Hindu	1
Kutch	17	1809	6500	512084	Hindu	1
Patiala	17	1809	5887	1467433	Sikh	5
Rewa	17	1812	1000	1305124	Hindu	4
Tonk	17	1817	2509	338029	Muslim	1
Alwar	15	1803	3024	682926	Hindu	1
Banswara	15	1818	1300	152045	Hindu	1
Datia	15	1804	836	182598	Hindu	1
Dewas	15	1818	2566	142162	Hindu	1
Dhar	15	1819	1740	149244	Hindu	1
Dholpur	15	1779	1200	249657	Hindu	1
Dungarpur	15	1818	1000	153381	Hindu	1
Idar	15	1812	4966	258429	Hindu	1
Jaisalmer	15	1818	16447	108143	Hindu	1
Kishangarh	15	1818	724	112633	Hindu	1
Orchha	15	1812	2000	311514	Hindu	1
Partabgarh	15	1818	1460	79568	Hindu	1
Rampur	15	1794	899	541914	Muslim	1
Sirohi	15	1823	3020	142903	Hindu	1
Bhavnagar	13	1807	2860	400323	Hindu	1
Cooch Behar	13	1773	1307	602624	Hindu	1
Dhrangadhra	13	1807	1142	99686	Hindu	1
Jaora	13	1818	872	108434	Muslim	2
Jhalawar	13	1838	2694	340488	Hindu	1
Jind	13	1809	1323	294862	Sikh	1
Junagadh	13	1807	3283	387499	Muslim	2
Kapurthala	13	1846	620	252617	Sikh	1
Nabha	13	1809	928	261824	Sikh	1
Nawanagar	13	1807	1379	316147	Hindu	1
Palanpur	13	1809	3150	234402	Muslim	1

Native state	No. of guns in salute	Date of treaty with British	Area (sq.miles)	Population (1896)	Religion of ruler	No. of modern districts
Porbandar	13	1807	636	71072	Hindu	1
Rajpipla	13	1821	1514	59834	Hindu	1
Ratlam	13	1819	729	87314	Hindu	1
Ajaigarh	11	1807	802	81454	Hindu	1
Ali Rajpur	11	1818	836	56287	Hindu	1
Barwani	11	1818	1362	56445	Hindu	1
Bijawar	11	1811	973	113285	Hindu	1
Bilaspur	11	1846			Hindu	1
Cambay	11	1771	350	86074	Muslim	1
Chamba	11	1846	3180	115773	Hindu	1
Charkhari	11	1804	787.5	143015	Hindu	1
Chhatarpur	11	1806	1169	164376	Hindu	1
Faridkot	11	1809	612	97034	Hindu	1
Gondal	11	1807	687	135604	Hindu	1
Jhabua	11	1821	1336	147100	Hindu	1
Mandi	11	1846	1000	147017	Hindu	1
Morvi	11	1807	821	90016	Hindu	1
Narsingharh	11	1818	623	112427	Hindu	1
Panna	11	1807	2568	227306	Hindu	1
Pudukkottai	11	1803	1101	302127	Hindu	1
Radhanpur	11	1813	1150	98129	Muslim	1
Rajgarh	11	1818	655	117533	Hindu	1
Sailana	11	1819	114	29723	Hindu	1
Sirmur	11	1815	1077	112371	Hindu	1
Tehri Garhwal	11	1820	4180	199836	Hindu	3
Wankaner	11	1807	376	30491	Hindu	1
Balasinor	9		189	46328	Muslim	1
Bansda	9	1802	384	34122	Hindu	1
Chhota Udepur	9	1822	873	71218	Hindu	1
Dharampur	9		794	101289	Hindu	1
Dhrol	9		400	21177	Hindu	1
Kalahandi	9	1829				1
Khilchipur	9	1818	273	36125	Hindu	1
Limbdi	9		344	40186	Hindu	1
Maihar	9		400	71709	Hindu	1
Mayurbhanj	9	1829	4243	385737	Hindu	2
Nagod	9	1809	450	79629	Hindu	1
Rajkot	9	1807	283	46540	Hindu	1
Sangli	9		896	196832	Hindu	1
Savantwadi	9	1730	900	174433	Hindu	1
Bashahr	9	1815	3320	64345	Hindu	1
Dhenkanal		1829	1463	208316		1
Keunjhar		1829	3096	215612	Hindu	1
Raigarh			1486	128943		1
Sarguja		1817	6055	270311	Hindu	1

Native states listed in decreasing order of the number of guns in ceremonial salute.

Number of modern districts refers to the number of districts containing areas from the native state.

Several modern districts contain areas from more than one native state.

Native state boundaries may or may not coincide with modern district boundaries.

## **APPENDIX TABLE 2 : DATA SOURCES**

### **Post-Independence data**

Data on district geography, crop areas, yields, irrigation, fertilizer use, adoption of high-yielding varieties: India Agriculture and Climate Data Set (World Bank)  
<http://www-esd.worldbank.org/indian/home.cfm>

Public goods at village-level 1961, 1981, 1991: Census reports

District level data on population, literacy, occupation classes, proportion of scheduled castes etc:  
Indian Database Project Vanneman, Reeve and Douglas Barnes (2000)  
Indian District Data, 1961-1991: Machine-readable data file and codebook, Center on Population, Gender, and Social Inequality, College Park, Maryland.  
URL: <http://www.bsos.umd.edu/socy/vanneman/districts/index.html>

### **Matching post-Independence districts with British districts and native states**

Districts and maps of British India: Baden-Powell (1892)  
Districts and maps of modern India: <http://www.mapsofindia.com>  
District Gazetteers (various issues)

### **Historical data**

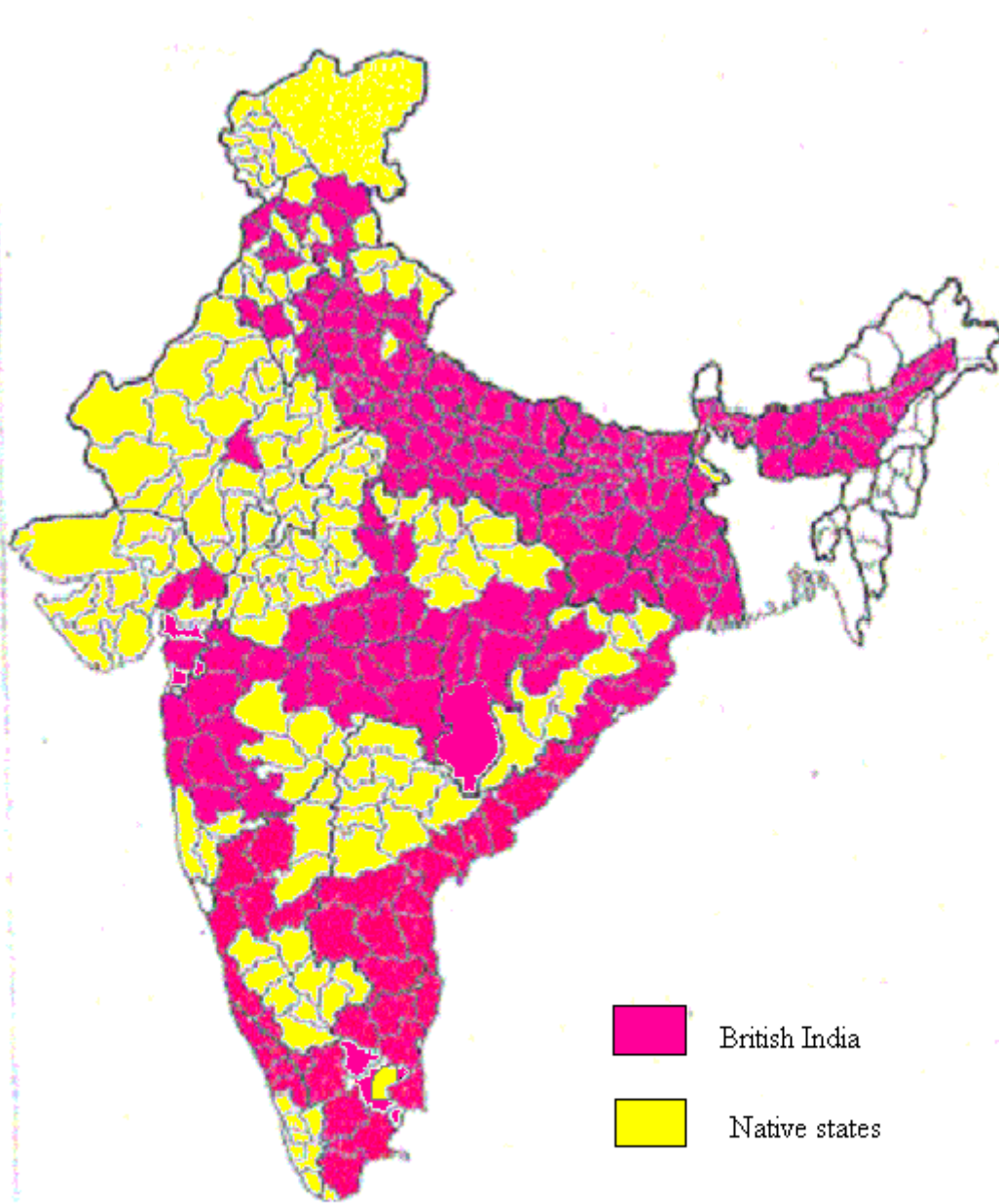
Area and revenue of Native States: Chakrabarti (1896), Hunter et.al. (1908)

Details of death of kings in Native States: District Gazetteers; Lee-Warner (1904);  
<http://www.dreamwater.net/regiment/RoyalArk/India/India.htm>;  
<http://www.uq.net.au/~zzhsoszy/ips>

Literacy and infant mortality in earlier periods : District Gazetteers

**APPENDIX TABLE 3 : DETAILS OF NATIVE STATES WHERE RULERS DIED WITHOUT NATURAL HEIR IN 1848-56**

Native state	Year of death of ruler	Details
<u>Major kingdoms annexed by Lord Dalhousie</u>		
Satara	1848	State created in 1818 for defeated Maratha ruler; ruler deposed in favor of his brother in 1842; state annexed by lapse in 1848.
Sambalpur	1849	Part of Bhonsla kingdom originally; handed over to a local ruler Maharaja Sahi in 1818 and to his queen on his death in 1827. Kingdom given to relative Narayan Singh in 1833 after local insurrection. Annexed by Doctrine of Lapse in 1849 when ruler died without heir.
Jhansi	1853	First treaty of protection with British in 1804; ruler died without heir in 1835 and in 1838 but successors installed by British and state not annexed; state annexed by Lord Dalhousie due to lapse in 1853.
Nagpur	1854	Bhonsla ruler defeated in 1818 and kingdom put under British administration till 1830; Taken over by Doctrine of Lapse in 1854 after death of ruler in December 1853.
<u>Major kingdoms where rulers died without heir in 1848-56 but which were not annexed</u>		
Orchha	1852	Lord Dalhousie did not annex on grounds of Orchha being a non-tributary state; also the British had a prior agreement with the queen (made in 1841) which allowed her to adopt an heir.
Karauli	1853	Ruler died without heir in 1853; Lord Dalhousie recommended annexation but was disallowed by the East India Company's Court of Directors.
Chhatarpur	1854	Ruler died without heir in 1854, and was succeeded by his nephew.
Ajaigarh	1855	Ruler died without heir in 1855 and the state was annexed by Lord Dalhousie. Royal family remained loyal to the British during the 1857 revolt and the state was returned to an adopted heir by Lord Canning in 1857.



**Figure 1 : British India and Native States**