

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

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Abstract

This paper compares economic outcomes across areas in India which were under the direct colonial rule of British administrators with areas which were under indirect colonial rule. I take advantage of a specific annexation policy of the British, called the “Doctrine of Lapse”, 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; further, 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 are narrowing over time in the post-Independence period.

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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 colonies of European powers. Many of these areas are extremely poor today: in terms of per capita GDP in 1995, the poorest twenty countries in the world are all ex-colonies. There are different views on whether such underdevelopment is caused by colonial rule in the past. Several scholars have emphasized factors such as excessive exploitation of colonies, drain of resources or the growth of a “dependency” complex to argue that colonial rule has long-term negative effects on development (see Frank 1978, or Bagchi 1982). On the other hand, there is 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 (e.g. Herbst 2000, on Africa, or Roy 2002, on India). Research has also been focused on specific aspects of or institutions created by colonial rule. Bertocchi and Canova (2002) find that the economic performance of British colonies in Africa is less volatile than that of French and German colonies. Engerman and Sokoloff (1997, 2000) and Acemoglu, Johnson and Robinson (2001, 2002) argue that property rights institutions created by colonial powers have very long-term consequences. La Porta et. al. (1998a, 1998b) and Berkowitz et. al. (2004) focus on the long-run effects of legal systems put in place by different colonial powers, while Banerjee and Iyer (2003) focus on the role of British colonial land tenure systems in India. However, these papers do not include comparisons with areas which were not European colonies.

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 colonialism is different from the indirect effect, we are faced with the problem of selection: are some countries 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 compare the long-term outcomes of areas which were under direct British colonial rules with those which were under indirect colonial rule. Focussing on a single country has the advantage that the extent of omitted variables bias is likely to be less than in a cross-country sample. Further, I am able to solve the selection problem by using the specific policies of British colonial rule in India. However, 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. Therefore, 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 controlled directly, 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 (the so-called “native states”) which were under the administration of Indian rulers. Indirect colonial rule in this setting meant that the defence and foreign policies of these native states were completely controlled by the British, but they enjoyed considerable autonomy in matters of internal administration. Therefore, any differences I observe are most likely to be due to the quality of internal administration. After the British left in 1947, all the native states were integrated into independent India, and have since been subject to a uniform administrative, legal and political structure. Therefore, differences in current institutions are unlikely to be driving my results.

Using Indian district level data from the post-Independence period, I find that directly-ruled British areas have significantly higher agricultural investments and productivity in the 1956-1987 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 selected for direct British rule. To overcome this potential selection bias, I construct an exogenous determinant of British empire status by taking 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 earlier OLS results were 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 instrumental variable strategy. In particular, I conduct a “falsification exercise” where I consider deaths of rulers without natural heirs 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). I find no significant differences here, supporting the conclusion that it is the fact of direct colonial rule which matters for the long run, rather than other aspects of historical ruler deaths.

Using data from an earlier period, I find some indications that the public goods differences I observe between British areas and native state areas are narrowing over time. Historical evidence also suggests that some native states were ahead of the British in the provision of public goods. 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 the nature of indirect colonial rule in the native states. 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 Direct and indirect British colonial rule in India

2.1 How did the “native states” emerge?

The British empire in the Indian subcontinent lasted nearly 200 years. Beginning in 1757, all the areas of present-day India, Pakistan, Bangladesh and Burma were brought under British political control by the middle of the nineteenth century. Of this area, “British India” was defined 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”;¹ the remaining areas were referred to as the “native states” or the “princely states” by the Colonial government and were ruled by hereditary kings.² About 680 native states were recognized by the Foreign Office in 1910.³ Native states constituted about 45% of the total area of British India (excluding Burma and Sind) and about 23% of the total population in 1911.

Table 1 shows the growth of British India over time. 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.

Why didn’t the British annex the whole Indian subcontinent? This was mainly because of a major policy change in the nineteenth century. 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 an uncoordinated uprising of soldiers who felt a threat to their religion and traditional practices (Spear 2002), or simply a mutiny by soldiers who wanted increased pay and greater career opportunities (David

¹Interpretation Act of 1889

²I use the term “native states” throughout the paper.

³The precise definition of a native state was the matter of some debate. Sir William Lee-Warner (1910), for instance, 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.” According to the Imperial Gazetteer (Hunter et. al. 1908), 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 practice, this meant that “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.” i.e. native states were those which had been recognized by the British as such.

2002). After some initial reverses, the British rallied and were able to suppress the mutiny by the end of 1858. The actions of the rulers of the native states during the revolt were varied: some rulers of previously annexed states (e.g. Jhansi) became leaders of the mutiny, and a few others (e.g. Rajgarh) explicitly or covertly helped the mutineers; however, many native states aided the British by supplying troops and equipment, or by defending the Europeans within their territory.

The mutiny was a major shock to British power in India. The administration of India was taken over by the British Crown from the East India Company in 1858, and, since the British felt that the native states had played an important role in helping them during the mutiny, plans of further annexation were given up, with the Queen’s proclamation of 1858 stating specifically that “We desire no extension of our present territorial possessions.” Thus, the areas which had not been annexed until 1858 continued to be native states till the end of British rule in 1947.⁴

2.2 A wide variety of native states

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. The majority of rulers were Hindu kings, though there were several Muslim and Sikh rulers as well. Appendix Table 1 lists details of the major native states in our data set.⁵ The map in Figure 1 shows the geographic distribution of native states. We see that 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 south, there were fewer and larger states. 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”.

⁴The one district added after 1858 is Panchmahals which was ceded by the ruler of Gwalior to the British in exchange for some other territory.

⁵In 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. The table lists the native states in order of the number of guns in the salute, reflecting their importance in the eyes of the British.

2.3 British policy towards the 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.

In the initial period of British rule (1765-1818), 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 because they wanted to maintain a “ring-fence” between their areas and the stronger empires of the Marathas and the Sikhs. This was exemplified, for instance, in Clive’s decision not to annex Oudh and Delhi in 1765 after the Battle of Buxar, or the decisions of Cornwallis and Barlow to return many conquered areas to Indian rulers in the peace treaties signed after the battles of 1802-1804.

In 1817-1818, the British won a series of battles against the Pindari raiders of central India, as well as the Maratha rulers of Poona, Nagpur and Indore. This set of military victories led to the British emerging as the dominant political power in the subcontinent. The British now followed the policy of “subordinate isolation”: all native states were made politically subordinate to the British and accepted the British as the “Paramount Power” in India. They could not declare war, establish relations with other states or employ Europeans without explicit British permission. Many of them signed treaties with the British which regulated the size of their armed forces and several native states 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 the native states in our data set, the tribute varied from zero to 28% of state revenue in 1896. However, they were allowed considerable autonomy in internal matters unless they had specific treaty provisions.⁶

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 (1848-1856), who annexed seven major native states (and several smaller ones).

As mentioned earlier, outright annexation of territory was given up in 1858; 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

⁶For 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” .

disturbance”.⁷ 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 some time before allowing the king to take up ruling powers again.⁸

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.

2.4 Native states in independent India

When the British left in 1947, all native states signed treaties of accession to the newly independent nations of India or Pakistan, sometimes under threat of military action. By 1950, all the native states within the borders of India were integrated into independent India, and were subject to the same administrative, legal, and political systems as those of the erstwhile British Indian areas. 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” by the Indian government, 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. The data I use is 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,⁹ 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”

⁷Lord Canning, Government of India Foreign Department Despatch No. 43A to S/S, 30 April 1860.

⁸Different 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).

⁹The 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.

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 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 productivity¹⁰ 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:

$$y_i = \alpha + \beta Brit_i + \gamma X_i + \epsilon_i \quad (1)$$

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.¹¹

¹⁰ Agriculture accounted for 37% of India's total GDP and 67% of the working population in 1981.

¹¹ For British empire areas, "native states" for the purpose of clustering 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".

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 regression 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 estimates of the impact of direct colonial rule

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 1956-1987, 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 IV estimates of the impact of direct 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 modern 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.¹² Of the remaining 65 native states (161 districts) where such a death did not occur, Lord Dalhousie annexed only three (18 districts).¹³ The policy of lapse thus meant that

¹²The 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.

¹³These 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

areas where the ruler died without a natural heir had a higher probability of being annexed. 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,¹⁴ 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 1848-1856 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 1848-1856 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.

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.

¹⁴Only one district (Jalaun) in our sample had been annexed because of lapse before Lord Dalhousie.

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 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. This is not surprising in view of the fact that land revenue was the biggest source of government revenue throughout the colonial period. 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 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.

I perform a number of robustness checks for the IV results. The estimates are robust to dropping the areas annexed by Lord Dalhousie for non-lapse reasons (Table 8, column (6)). The results are also fairly robust (regressions not shown) to the addition of soil type dummies (the overall estimate for the combined public goods regression is -0.062); to controlling 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;¹⁵ and to dropping the native states of Mysore and Travancore, which were arguably the best in terms of public goods provision.

5.3 Validity of ruler death as an instrument

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 ϵ in equation (1). In other words, if the event of ruler death without natural heir in the period 1848-1856 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.

First, it is possible that the event of a ruler dying without an heir might reflect some characteristics of the area (such as bad climate), or of the ruling family (such as genetic weaknesses), which might arguably affect long-term outcomes directly. To control for this, I re-run the regressions of public goods on the *Lapse* dummy after adding dummies for ruler death in 1848-1856 (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 (Table 9, column (2)). Further, these controls are usually insignificant in all the regressions.

Second, I check directly whether ruler death without natural heirs has any long-term impact

¹⁵This is especially true in the colonial period when the major cause of death was from epidemics and famines.

on public goods availability without British annexation. For instance, such a death may result in an extended period of political turmoil which might have lasting consequences. 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 died without a natural heir in the period 1858-1884 during which such a death would not result in British annexation.¹⁶ The estimates using this dummy are much lower in magnitude than the results using the *Lapse* dummy, and they are also statistically insignificant (Table 9, column (3)). 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”.¹⁷ 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 (Table 9, column (4)).

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. It is also not the case that the Doctrine of Lapse was put in place in order to obtain these particular states. Lord Dalhousie admitted that the states he most wanted were Oudh and Hyderabad;¹⁸ however, neither of these could be annexed by lapse, since the rulers of both states already had natural heirs when Dalhousie arrived in India. The Doctrine of Lapse thus seems to have been an additional means to annex more territory, and not targeted to any particular state. 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 British being suspicious of the validity of natural heirs.

¹⁶There were 14 such instances in this period, of which 12 happened in ten states large enough to form part of a native state district in our dataset.

¹⁷See Bertrand, Duflo and Mullainathan (2004) for details.

¹⁸“I have got two other kingdoms on hand to dispose of – Oudh and Hyderabad. Both are on the highroad to be taken under our management.” (Private correspondence in 1848, quoted in Rahim (1963)).

Finally, it was not the case that territories annexed by lapse were administered differently compared to areas annexed by other means. The lapsed areas were added to existing British provinces and brought under the prevailing administrative systems in those provinces. In particular, we should note that they were integrated into different British provinces: Nagpur and Sambalpur were merged with the Central Provinces, Satara with Bombay and Jhansi with the North-West Provinces. In the modern period, these areas belong to 4 different states. Thus, the results we observe cannot be attributed to a specific administrative difference.

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. Table 10 shows that these differences are reflected in outcomes like infant mortality rates, which are significantly higher in British areas when we compute IV estimates. We see no significant differences in literacy rates, which probably reflects the fact that the differences in primary schools are no longer significant in the 1981 and 1991 data.

6 Interpretation of results and additional evidence

The instrumental variables results above indicate that former British empire areas have lower levels of public goods in the post-Independence period. Table 11 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.¹⁹ 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 not present in the later period data. These results indicate that the differences we observe are growing smaller over time. We also note a similar trend in the infant mortality results in Table 10: the difference in 1991 is smaller than in 1981. On the other hand, 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). This seems to suggest that the public goods differences arose in the colonial period itself.

¹⁹The data on rural health centers, canals and roads are missing for several states in this year.

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.²⁰ This also suggests that British empire areas might be catching up in the post-Independence period. These data are more indicative than conclusive, because the small sample size prevents us from running regressions controlling for geography.

Anecdotal evidence also 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”.

Why might the native states be more committed to providing public goods in the colonial period? While we cannot give a definite answer to this question, we can rule out some possibilities. 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 possible that the British areas had higher defense spending, both because the British engaged in wars in places like Afghanistan, and because native states were explicitly prohibited from maintaining large armies; however, in the absence of detailed spending data from the native states, it is not possible to verify this. The results are also unlikely to be driven by 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:²¹ this is completely in-

²⁰Choice 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.

²¹The land revenue system was probably the single most important institution in the colonial period since land

significant and does not change the main IV coefficients.²² 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 by the British if they governed badly enough to provoke widespread protest.

It is indeed remarkable that the British-ruled areas continue to lag behind in public good provision as late as forty years after the end of colonial rule. This could perhaps be explained by the fact that public goods take time to build and an initial advantage might thus persist for a long time. We do observe that the gaps are narrowing over time and, in the case of primary schools at least, have been wiped out. There is also the possibility that the influence of local rulers continued to be felt in the post-colonial period: for instance, in the 1967 elections, 24 former princes were elected to the lower house of Parliament (Lok Sabha), and princely candidates did very well in state assembly elections as well (Allen & Dwivedi 1998). Richter (1975) also notes that “roughly a third of the 284 princely families which were guaranteed privy purses after integration have since fielded more than 150 legislative assembly or Lok Sabha candidates, the great majority of whom have been elected”. He also finds somewhat lower voter turnout and higher victory margins for candidates princely constituencies in the first few elections of the post-Independence period; the former effect diminishes over time. A more detailed examination of electoral performances as well as district-level expenditure allocations might shed more light on whether such candidates were more successful in lobbying for their local areas.²³

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. These differences are narrowing

revenue was the biggest source of revenue, both for British India and for the native states. See Banerjee and Iyer (2003) for evidence that historical land revenue systems caused persistent differences in outcomes within British India.

²²The 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.

²³District-level government expenditure data are not publicly available to the best of my knowledge.

over time, and so probably reflect differences from the colonial period. Given that the results cannot be wholly attributed to excessive extraction by the British or to differences in specific institutions, they 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 better performance, the policy implication would be to provide for better monitoring and greater punishments for policy-makers and administrators. It is interesting that we observe significant differences for as long as forty years after the end of colonial rule, which may be due to the continued prominence of former princes in political life. 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	
Geography					
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)
Demographic variables					
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)	(2)	(3)		(4)			(5)			
	no controls	Geography controls	Annexed before 1818	Annexed after 1818	Conquest	Ceded	Misrule	Lapse			
<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	yes	yes	yes	yes		
Proportion sandy/barren	no	yes	yes	yes	yes	yes	yes	yes	yes		
Soil type dummies	no	yes	yes	yes	yes	yes	yes	yes	yes		
# districts	271	271	271	271	271	271	271	271	271		
# native states	83	83	83	83	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
	(1) no controls	(2) Geography controls	(3) Geography + soil controls	(4) with date of annexation		(5) annexation			(6) British rule (*1/100)	
<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	yes	yes	yes	yes
Proportion sandy/barren	no	yes	yes	yes	yes	yes	yes	yes	yes	yes
Soil type dummies	no	no	yes	no	no	no	no	no	no	no
# districts	404	377	340	377	377	377	377	377	377	377
# native states	97	96	92	96	96	96	96	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
1848-1856	Dalhousie	8	20	4	16	3	18
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

	Coefficient on					
	British dummy Full sample		British dummy Post-1847 sample		British dummy Post-1847 sample (excluding Punjab, Oudh, Berar)	
	OLS (1)	OLS (2)	OLS (3)	Reduced form (4)	IV (5)	IV (6)
Mean of dep. var.						
(1)						
<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)	0.059 (0.065)	0.058 (0.053)
Fertilizer usage (kg/hectare)	20.04	7.014** (3.073)	3.770 (4.251)	-1.948 (2.323)	-3.145 (3.765)	-2.054 (2.669)
Proportion of cereal area sown with high-yielding varieties	0.330	0.066** (0.028)	0.083** (0.037)	0.031 (0.028)	0.051 (0.038)	0.061* (0.033)
Log total yield (15 major crops)	-0.161	0.213*** (0.080)	0.117 (0.119)	0.054 (0.079)	0.087 (0.127)	0.082 (0.105)
Log rice yield	-0.077	0.151* (0.083)	0.046 (0.120)	-0.064 (0.120)	-0.107 (0.215)	-0.090 (0.166)
Log wheat yield	-0.114	-0.064 (0.088)	-0.089 (0.113)	-0.114 (0.160)	-0.184 (0.243)	-0.164 (0.219)
<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	OLS (2)	OLS (3)	Lapse dummy Post-1847 sample	British dummy Post-1847 sample	British dummy Post-1847 sample (excluding Punjab, Oudh, Berar)
(1)	(2)	(3)	(4)	(5)	(6)	(6)	(6)
<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)	-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)	-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)	-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)	-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)	-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)	-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)	-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)	-0.065*** (0.019)
<u>Controls</u>							
Latitude, rainfall, coast		yes	yes	yes	yes	yes	yes
Proportion sandy/barren		yes	yes	yes	yes	yes	yes
# districts	377	163	163	163	163	145	145
# native states	96	71	71	71	71	68	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. (2004) 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
HEALTH AND EDUCATION OUTCOMES

Dependent variables	Mean	Coefficient on	
		British dummy Full sample	British dummy Post-1847 sample
		OLS	IV
Literacy rate (1961,1971,1981,1991)	0.309	0.017 (0.022)	0.019 (0.042)
Infant mortality rate 1981	118.7	-0.481 (7.48)	37.35** (14.20)
Infant mortality rate 1991	80.04	-0.772 (6.36)	26.87** (10.54)
<u>Controls</u>			
Latitude, rainfall, coast		yes	yes
Proportion sandy/barren		yes	yes
# districts		377	157
# native states		96	69

Robust standard errors in parantheses

* 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.

Infant mortality rate is computed as the number of deaths per 1000 live births.

TABLE 11
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 12
LITERACY RATES IN 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	Native states		Difference
	British empire	Native states	
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.

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	8,570	2,185,005	Hindu	3
Gwalior	21	1781	29,046	3,115,857	Hindu	9
Hyderabad	21	1759	98,000	9,845,594	Muslim	20
Kashmir	21	1846	80,000	1,534,972	Hindu	14
Mysore	21	1799	24,723	4,186,188	Hindu	10
Bhopal	19	1817	6,873	954,901	Muslim	3
Indore	19	1805	8,400	1,054,237	Hindu	3
Kolhapur	19	1766	2,816	800,189	Hindu	1
Travancore	19	1723	6,730	2,401,158	Hindu	6
Udaipur	19	1818	12,670	1,494,220	Hindu	3
Bharatpur	17	1803	1,974	645,540	Hindu	1
Bikaner	17	1818	22,340	509,021	Hindu	3
Bundi	17	1818	2,300	254,701	Hindu	1
Cochin	17	1791	1,361	600,278	Hindu	3
Jaipur	17	1818	14,465	2,534,357	Hindu	3
Jodhpur	17	1818	37,000	1,750,403	Hindu	5
Karauli	17	1817	1,208	148,670	Hindu	1
Kota	17	1817	3,797	517,275	Hindu	1
Kutch	17	1809	6,500	512,084	Hindu	1
Patiala	17	1809	5,887	1,467,433	Sikh	5
Rewa	17	1812	1,000	1,305,124	Hindu	4
Tonk	17	1817	2,509	338,029	Muslim	1
Alwar	15	1803	3,024	682,926	Hindu	1
Banswara	15	1818	1,300	152,045	Hindu	1
Datia	15	1804	836	182,598	Hindu	1
Dewas	15	1818	2,566	142,162	Hindu	1
Dhar	15	1819	1,740	149,244	Hindu	1
Dholpur	15	1779	1,200	249,657	Hindu	1
Dungarpur	15	1818	1,000	153,381	Hindu	1
Idar	15	1812	4,966	258,429	Hindu	1
Jaisalmer	15	1818	16,447	108,143	Hindu	1
Kishangarh	15	1818	724	112,633	Hindu	1
Orchha	15	1812	2,000	311,514	Hindu	1
Partabgarh	15	1818	1,460	79,568	Hindu	1
Rampur	15	1794	899	541,914	Muslim	1
Sirohi	15	1823	3,020	142,903	Hindu	1
Bhavnagar	13	1807	2,860	400,323	Hindu	1
Cooch Behar	13	1773	1,307	602,624	Hindu	1
Dhrangadhra	13	1807	1,142	99,686	Hindu	1
Jaora	13	1818	872	108,434	Muslim	2
Jhalawar	13	1838	2,694	340,488	Hindu	1
Jind	13	1809	1,323	294,862	Sikh	1
Junagadh	13	1807	3,283	387,499	Muslim	2
Kapurthala	13	1846	620	252,617	Sikh	1
Nabha	13	1809	928	261,824	Sikh	1
Nawanagar	13	1807	1,379	316,147	Hindu	1
Palanpur	13	1809	3,150	234,402	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	71,072	Hindu	1
Rajpipla	13	1821	1,514	59,834	Hindu	1
Ratlam	13	1819	729	87,314	Hindu	1
Ajaigarh	11	1807	802	81,454	Hindu	1
Ali Rajpur	11	1818	836	56,287	Hindu	1
Barwani	11	1818	1,362	56,445	Hindu	1
Bijawar	11	1811	973	113,285	Hindu	1
Bilaspur	11	1846			Hindu	1
Cambay	11	1771	350	86,074	Muslim	1
Chamba	11	1846	3,180	115,773	Hindu	1
Charkhari	11	1804	788	143,015	Hindu	1
Chhatarpur	11	1806	1,169	164,376	Hindu	1
Faridkot	11	1809	612	97,034	Hindu	1
Gondal	11	1807	687	135,604	Hindu	1
Jhabua	11	1821	1,336	147,100	Hindu	1
Mandi	11	1846	1,000	147,017	Hindu	1
Morvi	11	1807	821	90,016	Hindu	1
Narsingharh	11	1818	623	112,427	Hindu	1
Panna	11	1807	2,568	227,306	Hindu	1
Pudukkottai	11	1803	1,101	302,127	Hindu	1
Radhanpur	11	1813	1,150	98,129	Muslim	1
Rajgarh	11	1818	655	117,533	Hindu	1
Sailana	11	1819	114	29,723	Hindu	1
Sirmur	11	1815	1,077	112,371	Hindu	1
Tehri Garhwal	11	1820	4,180	199,836	Hindu	3
Wankaner	11	1807	376	30,491	Hindu	1
Balasinor	9		189	46,328	Muslim	1
Bansda	9	1802	384	34,122	Hindu	1
Chhota Udepur	9	1822	873	71,218	Hindu	1
Dharampur	9		794	101,289	Hindu	1
Dhrol	9		400	21,177	Hindu	1
Kalahandi	9	1829				1
Khilchipur	9	1818	273	36,125	Hindu	1
Limbdi	9		344	40,186	Hindu	1
Maihar	9		400	71,709	Hindu	1
Mayurbhanj	9	1829	4,243	385,737	Hindu	2
Nagod	9	1809	450	79,629	Hindu	1
Rajkot	9	1807	283	46,540	Hindu	1
Sangli	9		896	196,832	Hindu	1
Savantwadi	9	1730	900	174,433	Hindu	1
Bashahr	9	1815	3,320	64,345	Hindu	1
Dhenkanal		1829	1,463	208,316		1
Keunjhar		1829	3,096	215,612	Hindu	1
Raigarh			1,486	128,943		1
Sarguja		1817	6,055	270,311	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.

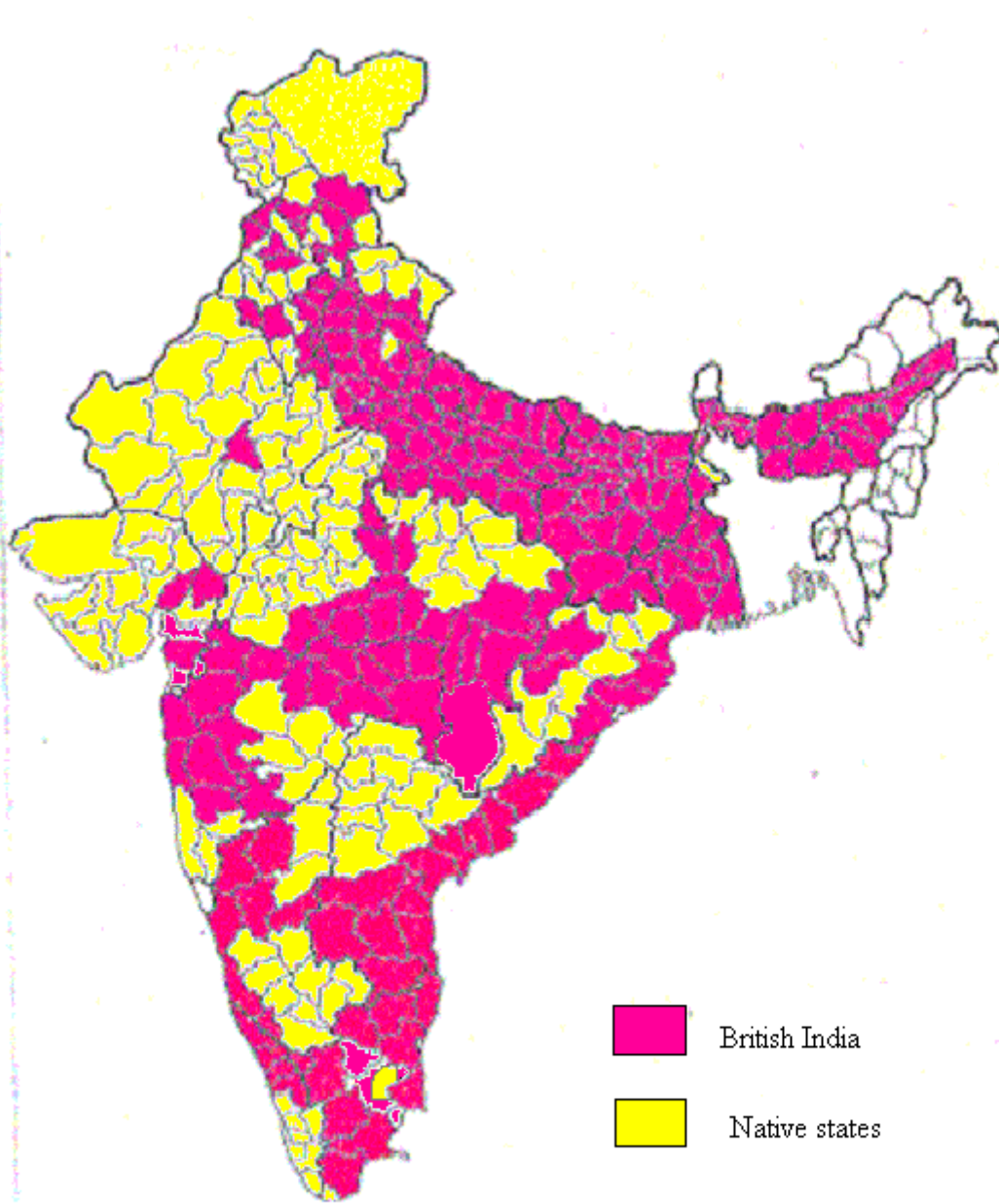


Figure 1 : British India and Native States